

OWNERS REPORT ON THE PLYMOUTH

POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND

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MAY 1956

35 CENTS



Read what happens when
THE ATOM STRIKES A VALLEY
Outboards Jam the Water
For the Craftsman
Build Your Own Greenhouse
CAMPING IN A STATION WAGON



***French Revolution
in the Air—page 112***



For fishermen who love their families



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*Electric Starting... Prices f.o.b. factory, subject to change... Mile Master Fuel System included with all models except the "3"... OBC certified brake hp. at 4000 rpm (30's at 4500).

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SEA-HORSES
FOR DEPENDABILITY



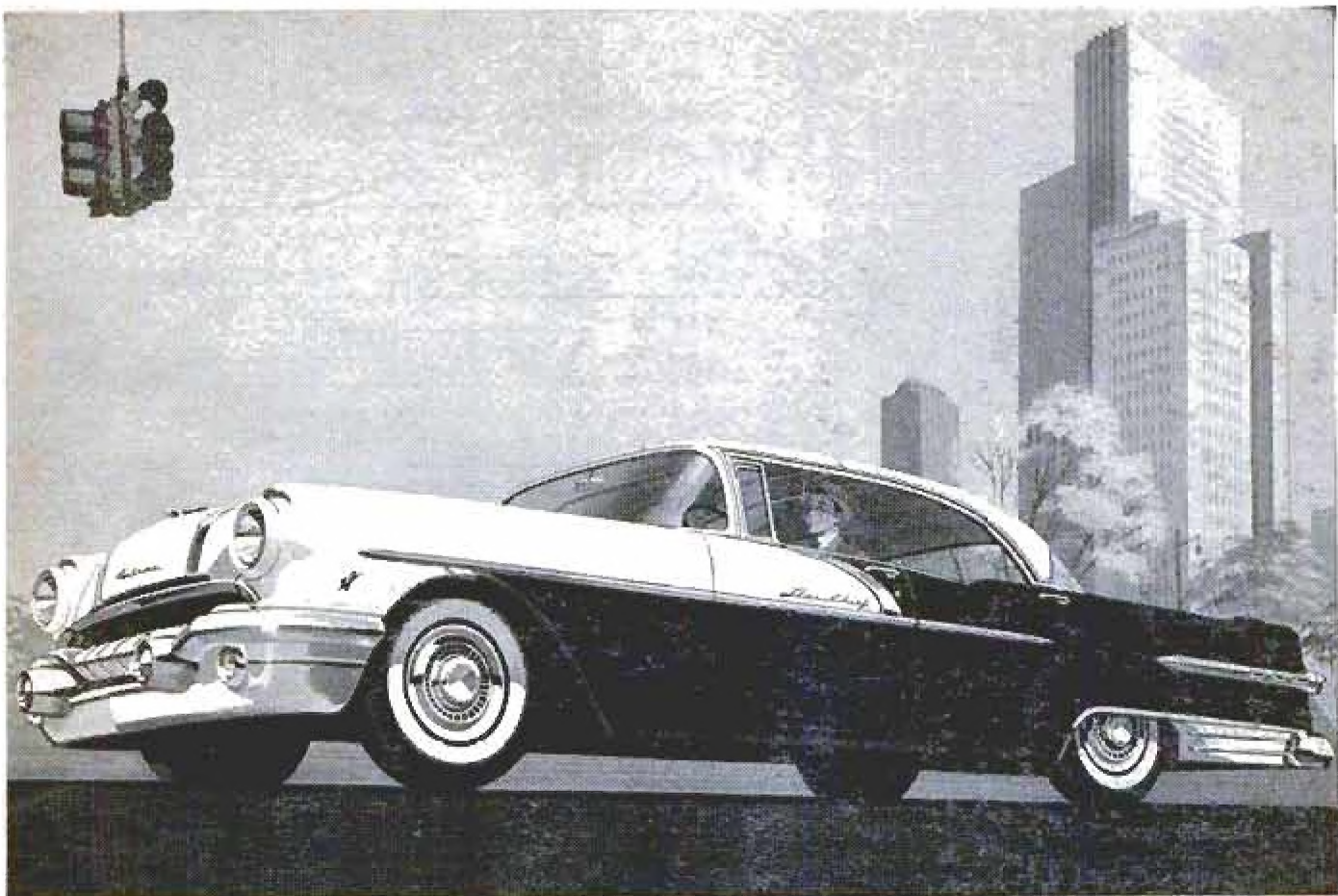
ASK COMMERCIAL USERS... SEA-HORSES WORK FOR THEM!

More than one smart fisherman has got the family on *his* side by sharing blue skies and open waters with them. The outboard cruiser does it! And leads the way to a new world of fishin' too! Here is golden family fun at little cost, thanks to Johnson's development of high-power outboard motors that carry a load — fast and far.

Talk to your Johnson Dealer. He *knows* the way to new adventure—to boatloads of family fun!

FREE! Write for your copy of the new Sea-Horse Booklet describing all models of the 1956 Johnson line. Complete, factual, helpful.

JOHNSON MOTORS, 400 Pershing Road, Waukegan, Ill.
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Come on in and see. Whether you're talking performance or price, *easy does it* with this fabulous '56 Pontiac!

This One



Z6DF-3YK-542L



Over 40 models of the low-priced three cost more than a big, glamorous Pontiac 860.

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PONTIAC

Popular Mechanics Magazine

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H. H. WINDSOR, JR., Editor and Publisher



Next Month

LIGHTNING PLAYS TRICKS that rival those of another much-publicized demon of nature—the tornado. One day a boy was sitting in a cart beneath a tree when lightning suddenly struck the tree. Three sides of the cart were sliced off but the boy was unharmed. In White Plains, N. Y., the entire side of a house was shorn off by a stroke of lightning and once a farmer's well went dry when lightning struck nearby. Lightning concerns almost everybody because each square mile of the United States receives an average of 10 strokes a year. Scientists have studied lightning for years and although they have made some progress in penetrating its mysteries they agree that the only predictable thing about it is that it's unpredictable. A June article, "Lightning Plays Queer Pranks," includes excerpts from a long-lost diary of the first weatherman stationed on Pikes Peak.

Information not listed on articles in the index, starting on page 74, frequently is listed in the **WHERE-TO-FIND-IT LIST**, which is available to readers without charge. A copy may be obtained by writing to the Bureau of Information, Popular Mechanics, 200 E. Ontario, Chicago 11, Ill.

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MAY 1956

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for other items and manufacturers of available products

Texaco Tips On Car Care

★ How to check your shock absorbers

Because shock absorbers are so vital to driving comfort — as well as control of your car — it's a good idea to check them regularly. Step on your car's bumpers and press down hard — as far down as they go. When you let go, the car should come up smoothly and rather slowly. If it bounces up sharply or vibrates up and down, your "shocks" should be either repaired or replaced.



★ How to increase engine life, driving economy

Use Havoline Special 10W-30, the all-temperature oil. When you start 'er up, it's light — for flash lubrication, fast getaways. Yet when your engine heats up, it has body — for protection against sizzling engine heat. Yes, Havoline Special 10W-30 thinks for itself... saves you thinking about seasonal grades of oil. So change today, change regularly. Get Havoline Special 10W-30 from your Texaco Dealer, the best friend your car has ever had!



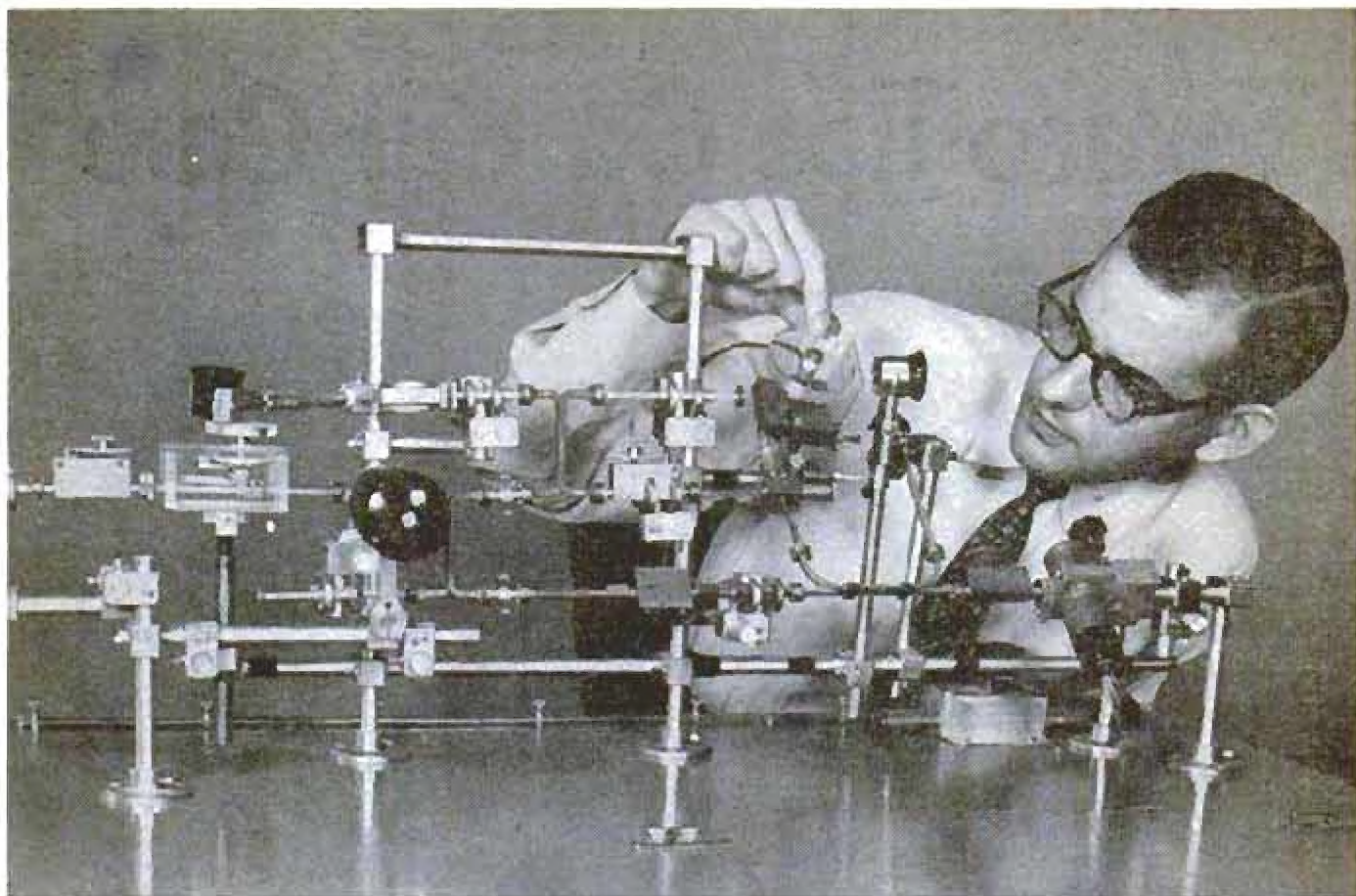
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Physicist G. K. Farney checks the frequency of Bell's new klystron, which is located at far right. Tube's output is about 20 milliwatts.

Sixty billion vibrations per second

A great new giant of communications—a waveguide system for carrying hundreds of thousands of voices at once, as well as television programs—is being investigated at Bell Telephone Laboratories.

Such a revolutionary system calls for frequencies much higher than any now used in communications. These are provided by a new reflex klystron tube that oscillates at 60,000 megacycles, and produces waves only 5 mm. long.

The resonant cavity that determines the frequency is smaller than a pinhead. The grid through which the energizing

electron beam is projected is only seven times as wide as a human hair, and the grid "wires" are of tungsten ribbon $3/10,000$ inch in width.

G. K. Farney, University of Kentucky Ph.D. in nuclear physics, is one of the men who

successfully executed the development of the klystron. Dr. Farney is a member of a team of Bell scientists whose goal is to harness the immense bandwidth available with millimeter waves . . . and to keep your telephone system the world's best.



Grids in new tube, enlarged 30 times, with human hair for comparison. Electronic beam passes through smaller, then larger, grid.

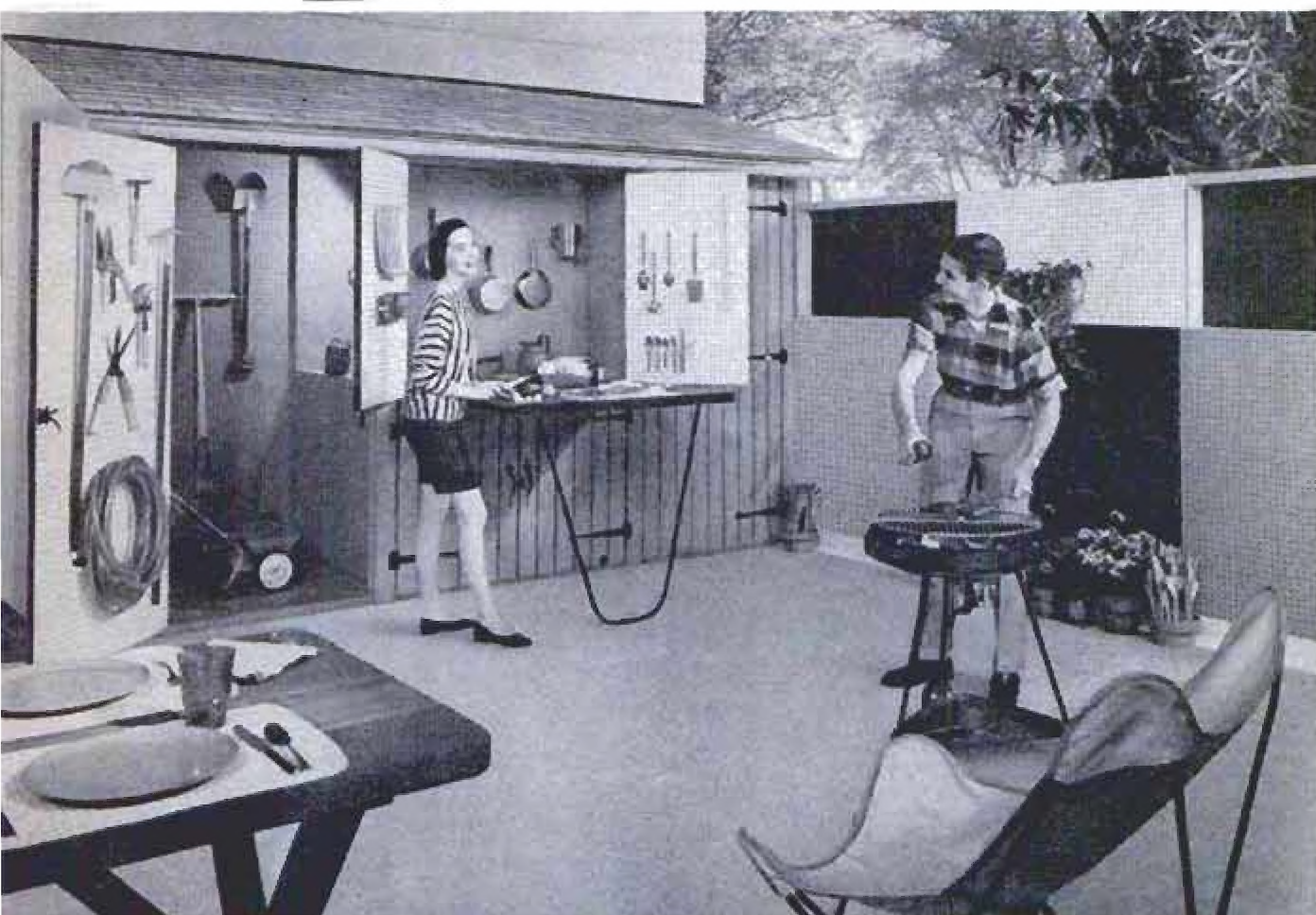


Wavelengths produced by the klystron tube are only .2 inch long— $1/15$ that of the transcontinental radio relay system.

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Whitworth $\frac{3}{16}$ — $\frac{3}{8}$ Opening Sockets. For repair of foreign cars and motorcycles. Nos. 5206W-5212W— $\frac{3}{8}$ " drive.



Double Hex Sockets. For elastic stop nuts. Nos. 4708T-4714T ($\frac{1}{4}$ "— $\frac{3}{16}$ " openings)— $\frac{1}{4}$ " drive. Nos. 5210-5228— $\frac{3}{8}$ " drive ($\frac{5}{16}$ "— $\frac{7}{8}$ " openings)— $\frac{3}{8}$ " drive.

5683



Eastern Factory, Jamestown, N.Y. • Canadian Factory, London, Ont.

ACROSS THE DESK



Throw-Away Houses Coming?

How would you like a disposable house—one you could throw away after 20 years of use? Are houses too well built nowadays? Should they be built, instead, of materials that would depreciate completely and be ready for the junk pile in two decades? These questions were recently tossed around at a meeting of architects and builders at the Illinois Institute of Technology in Chicago. One architect suggested that houses should be junked like cars when they become outmoded and replaced with new models. All deplored the fact that houses of today are built like monuments to last generations. The big stumbling block is to find an inexpensive material that will wear out in 10 or 15 or 20 years. When they do—look out. The only hope for people living in a 1915 or 1930 model is that it may be a classic like some of the old cars.

★ ★ ★

Why people want to fly over rivers and count the salmon swimming upstream is of no concern to this youngster. If he knew what they were about he would regard

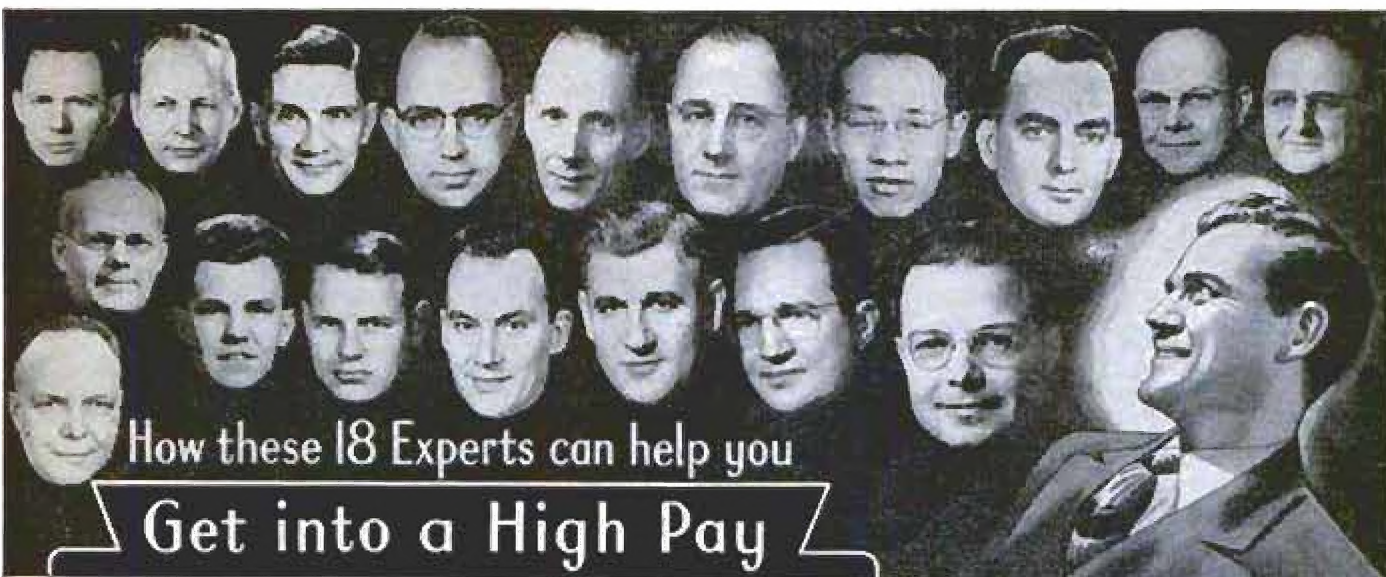


their mission as a bit silly. But he does have a deep personal interest in the biologists, really; they give him bubble gum. Read the story of the piscatorial census takers—"Shooting Salmon From the Sky"—on page 130.

To the Editor:

Your article "Ships That Buck the Polar Seas" was very interesting. However, the

(Continued to page 8)



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LaSalle's famous staff of Accounting authorities are helping thousands prepare for fast promotions and bigger pay. They can do the same for you!

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(Continued from page 6)

author made a slight error: the Coast Guard does not have an icebreaker smaller than the Wind class named the *Mackinac*. The *Mackinac* is a 311-foot AVP stationed at St. George, Staten Island. The Coast Guard does have a larger icebreaker on the Great Lakes named the *Mackinaw*, 290 feet long and of such a beam that she cannot leave the lakes.

Cadet George F. Viveiros, Jr.,
U.S. Coast Guard Academy,
New London, Conn.

Cadet Viveiros is right. Editor Richard F. Dempewolff, who radioed his story in the March issue from Antarctica, confused the two ships of similar but not identical names.

Correction

In the automobile-specifications chart of our February issue, the price of a Chevrolet Bel Air V8 four-door sedan with automatic transmission was incorrectly given as \$2223. The correct price of this car is \$2322, which includes federal excise tax and dealer-handling charges, but does not include transportation to your city and state or local taxes.

To the Editor:

The enclosed picture is of the car my son and I recently completed. Being an ardent reader of your magazine, we have



seen pictures of little cars in it; ours turned out very successfully, with some of the ideas coming from your magazine. The car is powered by a 2½-horsepower Briggs and Stratton air-cooled engine with a centrifugal clutch and dual-belt drive to rear wheels. It seats two, has a wheelbase of 52 inches and a tread of 33 inches. Steering is similar to large automobiles with kingpins. The front axle is pivoted in the center and has coil springing, giving semiknee

(Continued to page 10)



This man is a "security risk"!

Age, 29. Married. Two children. High school education. Active in local lodge, church, veterans' organization. Employed by large manufacturing concern. Earns \$82 a week.

Sounds like an Average Joe. And he is. Too average! He's got a job. It pays fairly well. He's satisfied.

But here's the catch. With the right kind of training, this young

man could be stepping into better jobs. He could be making \$7-8000 a year. He could be cashing in on those spare-time hours he now wastes.

As it stands now, he's stuck in his job. Can't seem to make any headway. He's reluctant to try. So he just hangs on.

This man is a "Security Risk" to his wife and children.

His family probably will never enjoy the comforts, the prestige, the good living that could be theirs. If hard times come, they are almost sure to be hurt. For an Average Joe can't expect to compete with trained men when the chips are down.

A man like this would do well to start a planned program of self-improvement. In his spare time. In a field related to his interests and abilities. Right NOW!

One good way to start—a way proved by hundreds of thousands of once-Average Joes who are making good today—is to enroll for special training with a recognized correspondence school. One like I. C. S., the oldest and largest in the world.

Don't you be a "Security Risk." Mail the coupon for full, free details while there is still time.

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Please rush me copies of the three books listed here—without cost or obligation.

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action. Hood is covered with galvanized tin plate, the rear of sections from automobile fenders. Top speed is approximately seven miles per hour. Gearing can be changed, when present driver becomes more proficient, to give a higher top speed.

E. G. Apple,
Burlington, N. C.

Ye Old Horseless Carriage Race

Chicago's Museum of Science and Industry has shown us a letter received recently from John L. Ovendon of Newcastle, New South Wales, Australia, inquiring the outcome of the famous "Race of the Horseless Carriages" sponsored by *Popular Mechanics* back in 1951. In that colorful event two Museum staff men who rebuild old cars staged a race from Chicago to New York, pitting a 1913 Stanley Steamer against a 1911 Stoddard-Dayton. The victory of the ancient steam car over its four-cylinder rival gas buggy was recorded in our November 1951 issue.

To the Editor:

It is most gratifying to see coverage of our recently installed induction-heating unit (the largest in the world) on page 130 of your March issue. You have presented the facts in a concise manner, sufficiently

technical, yet clear and direct. To you this would be a routine assignment. To us it is a further demonstration of the standard of coverage and reporting maintained by your magazine.

Charles D. Heap,
Public Relations Officer,
Western Canada Steel, Ltd.,
Vancouver, B.C.

To the Editor:

There's at least one man around Santa Fe, N. Mex., whom people have no trouble finding. They are apt to be directed by something like, "Look for the place with the screwy mailbox." It is literally screwy. The support is part of a feed screw out of a ready-mix concrete machine, scrounged from a junk yard.



James Wing,
Santa Fe, N. Mex.

"My Army job training was made to order!"

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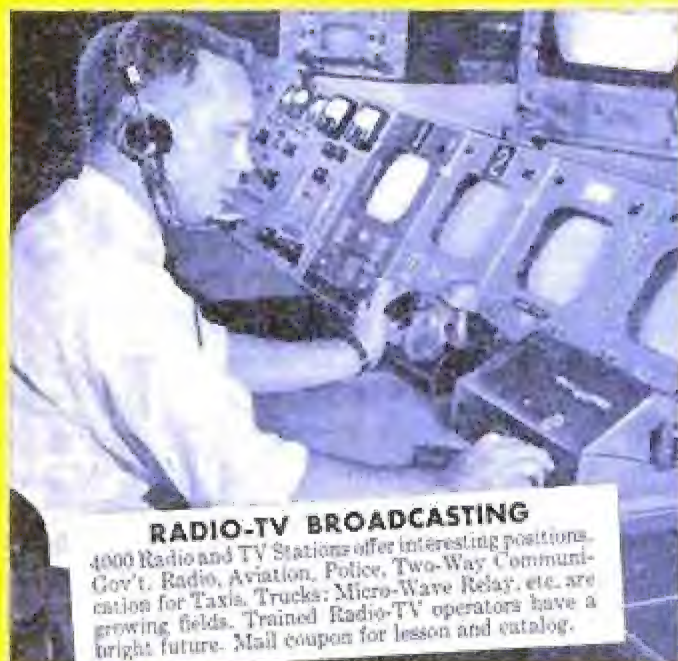
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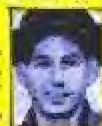
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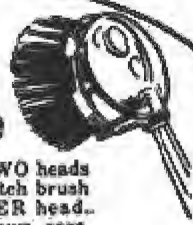
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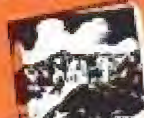
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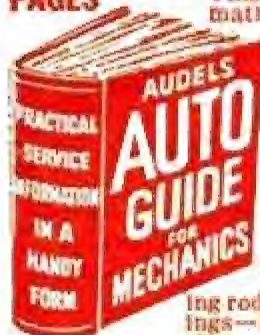
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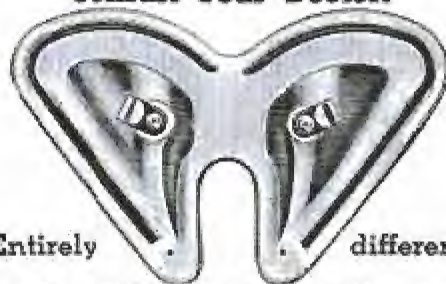
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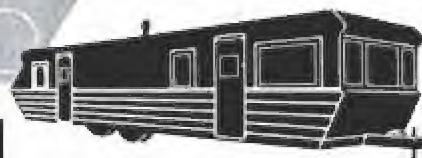


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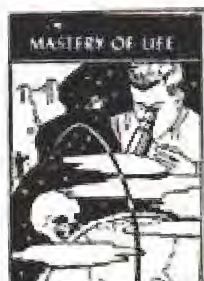
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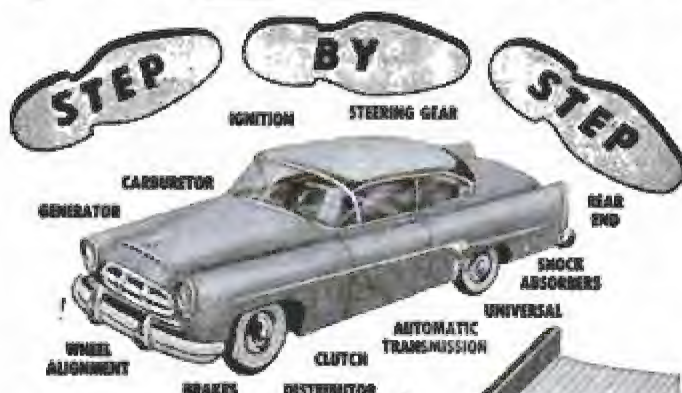
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550-17	5.22	670-16	5.32
650-15	5.42	780-16	7.72
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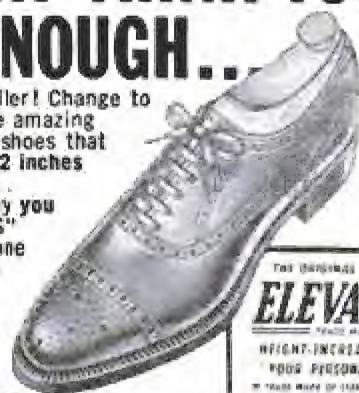
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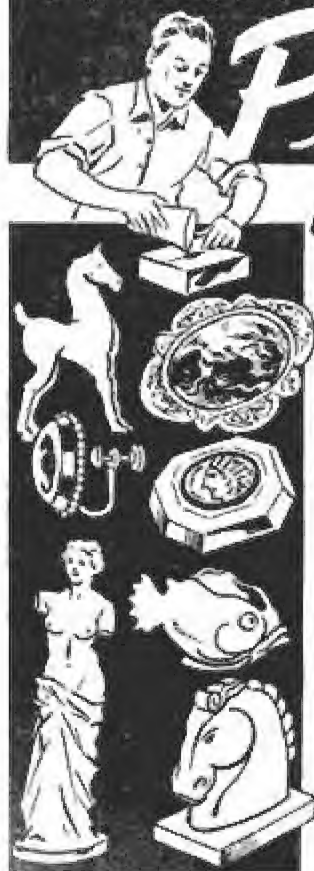
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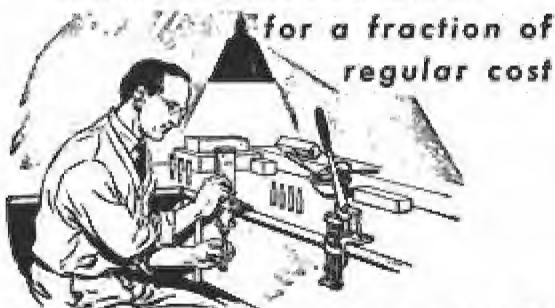
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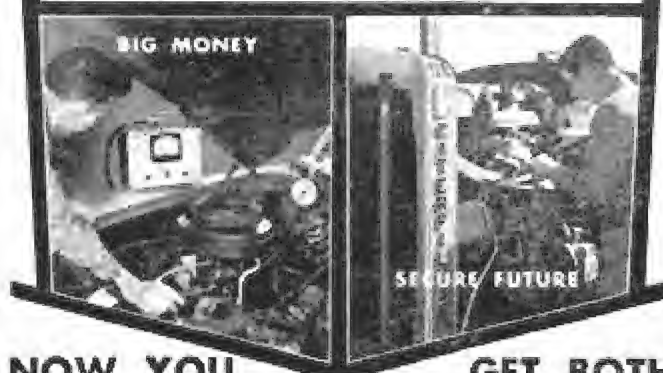
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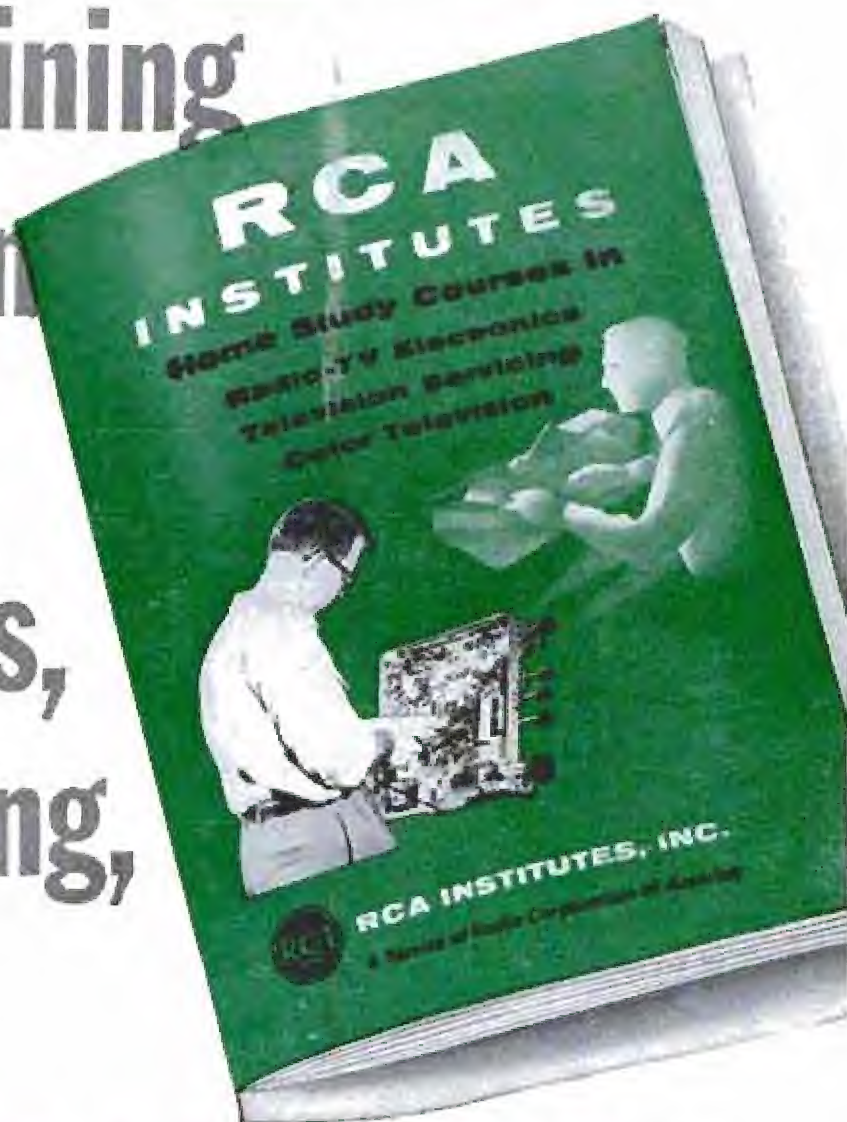
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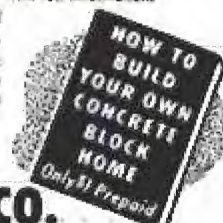
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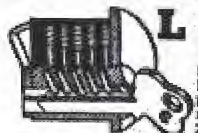
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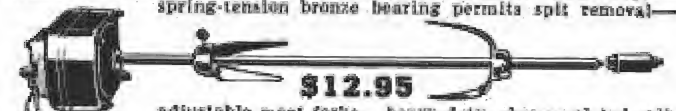
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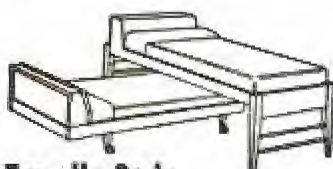
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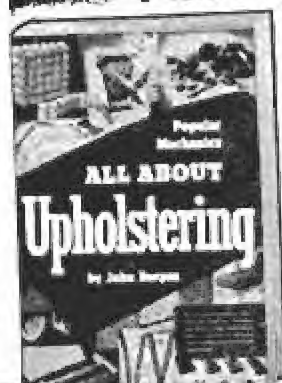
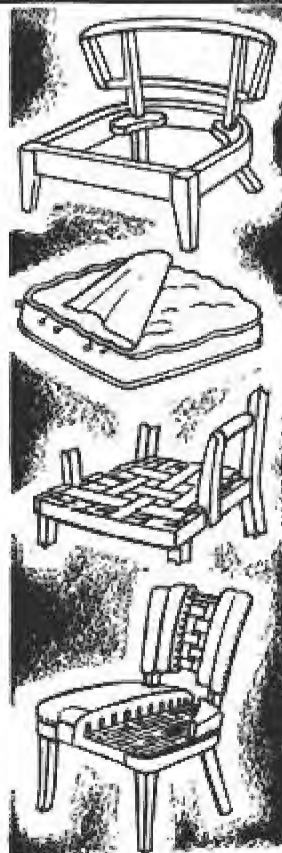
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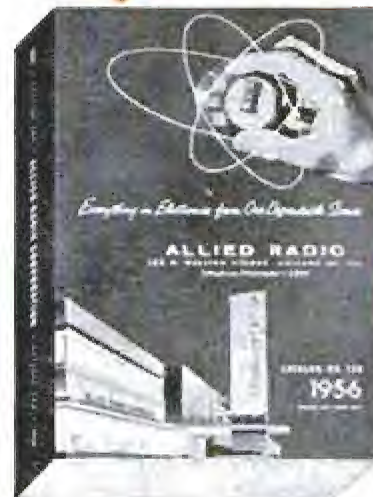
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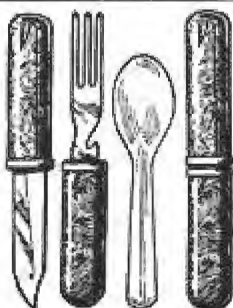
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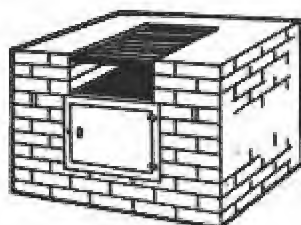
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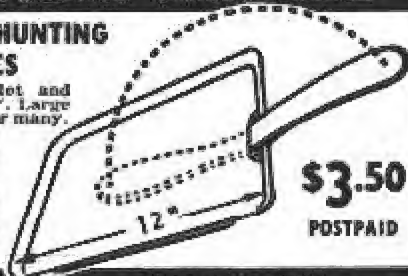
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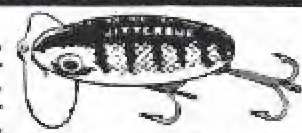
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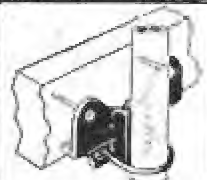
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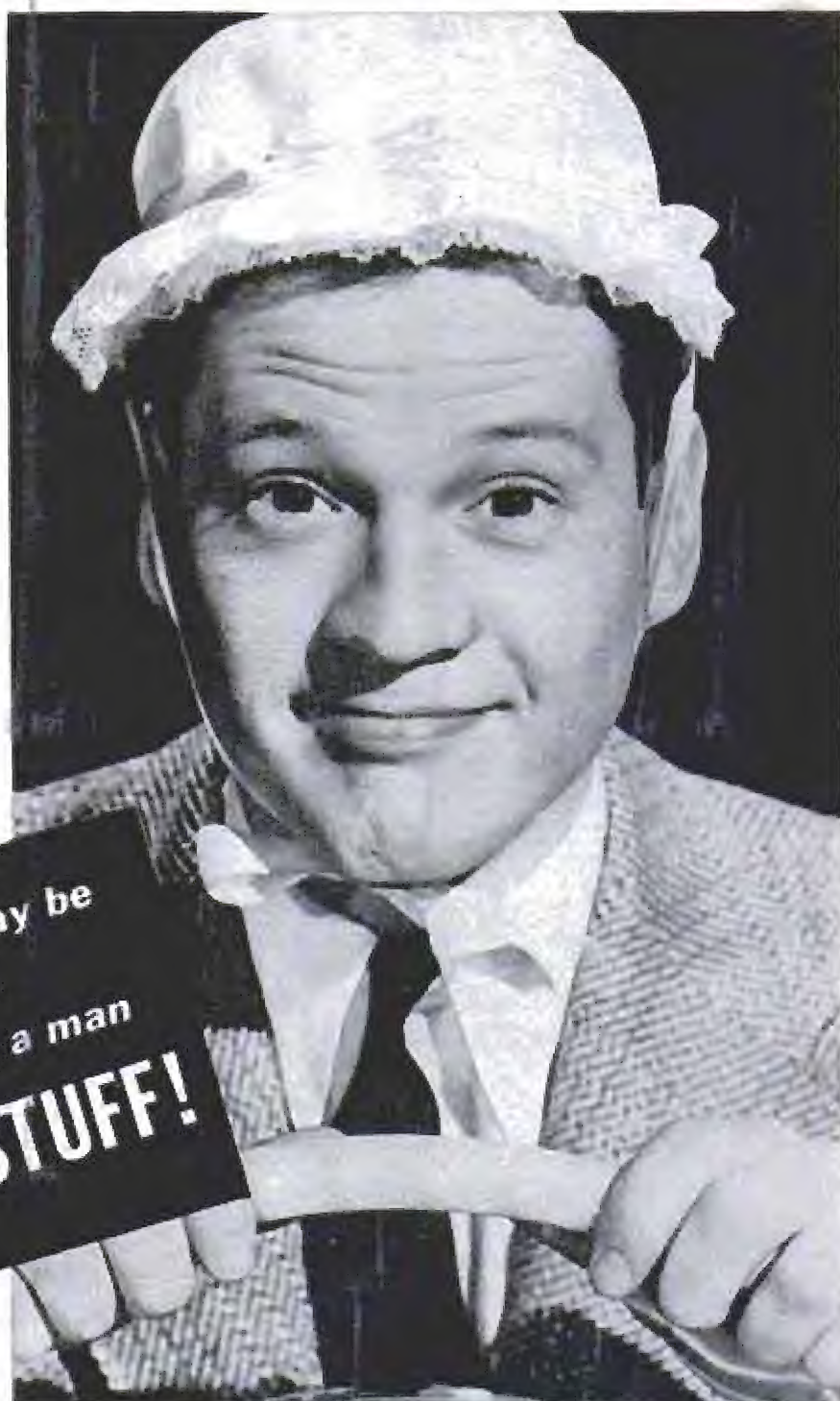
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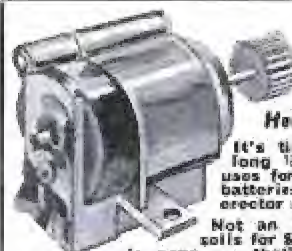
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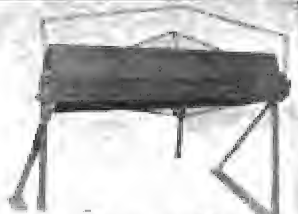
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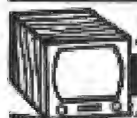


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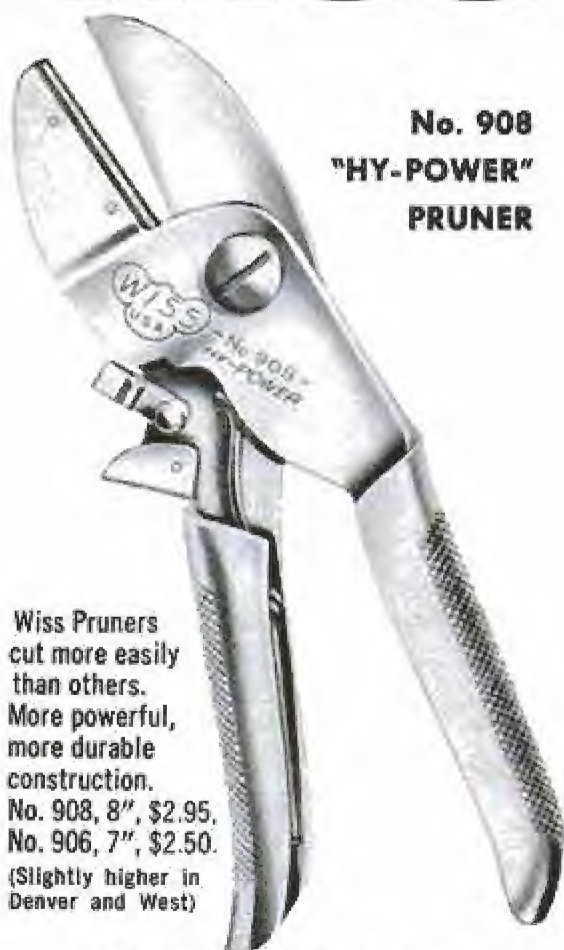


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Ⓐ A new type of dry-process enlarging printer, capable of reproducing 15 standard-size engineering drawings a minute from microfilm originals, has been developed by the Radio Corporation of America.

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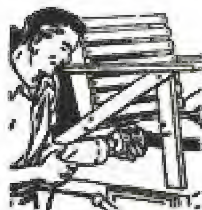
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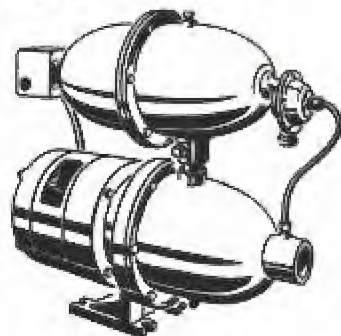
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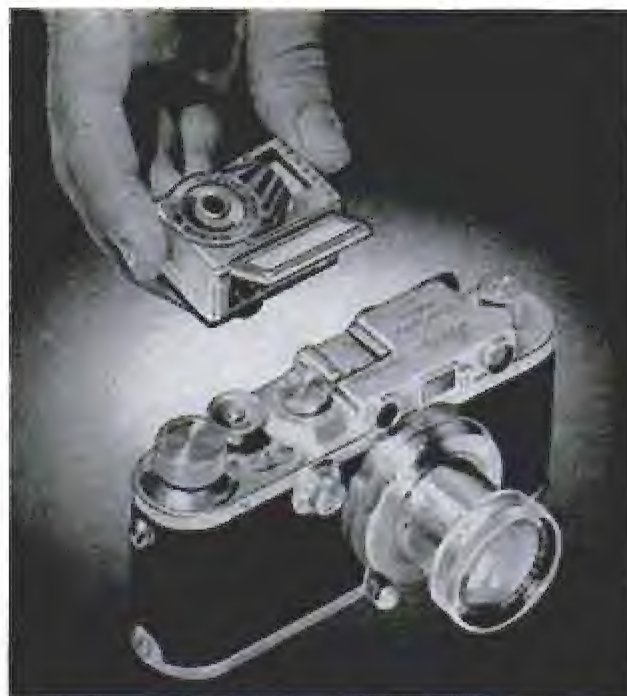
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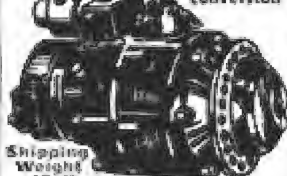
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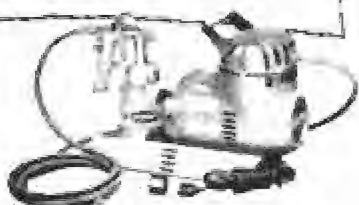
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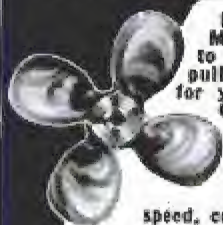
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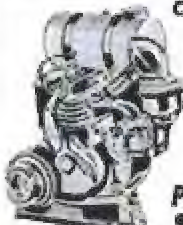


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Scientists Measure Twinkle of Stars

Twinkling in stars is caused when pockets of air of various densities pass between the star and the viewer. And now astronomers at the University of Pennsylvania are going to measure the twinkle with electronic meters, and compare their findings with weathermen's reports of upper-air direction and velocity. If they can find a relationship and reduce it to a formula, it may be possible to gauge upper-air winds in the future by measuring starlight.

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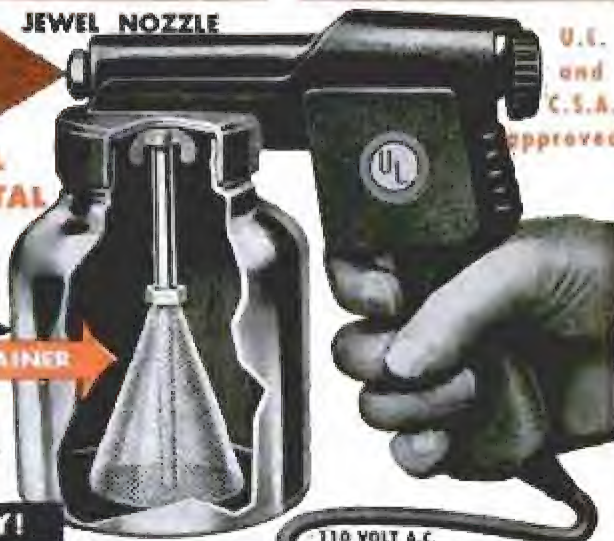
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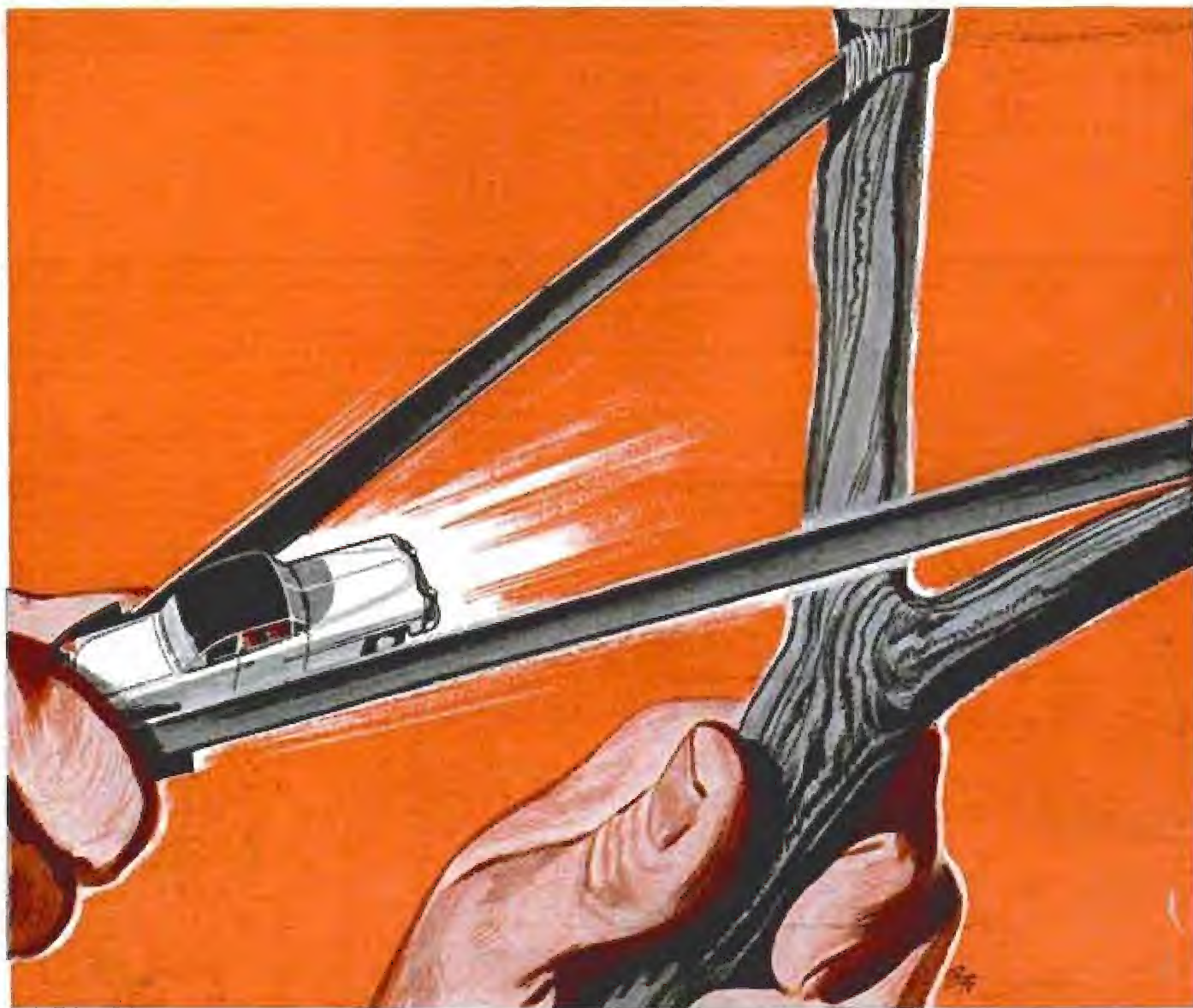
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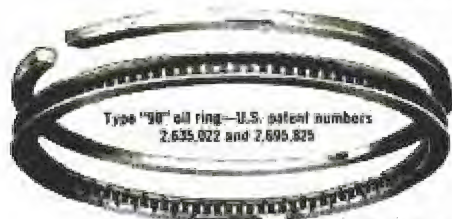
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THE STANDARD OF COMPARISON

Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., Toronto, Ontario.



AT 11:00 O'CLOCK on the morning of August 12, 1952, the Atomic Energy Commission announced in Washington, D. C., that it was investing \$1,000,000,-000 of the taxpayers' money in a vast new gaseous-diffusion plant. This atomic factory would be built into the Scioto River Valley of southern Ohio.

A few minutes later a congressman picked up his phone and placed a call to the old industrial town of Portsmouth, Ohio. The call brought the news to Portsmouth. For a decade the town had been slowly fading. Jobs were scarce, school kids disappeared upon graduation, and the population had been dropping steadily since the depression.

By midnight it was apparent to the people of Portsmouth that some sort of atomic bomb had been dropped on their town. The hotels suddenly were jammed, long-distance lines were tied in knots and speculators were swarming into the area.

The next morning trailer-camp operators started dickering for choice tracts along Highway 23 which runs north out of Portsmouth to the area selected for the atomic plant some 22 miles away. Scouts for restaurant chains hustled into town, and speculators were picking up options on corn-fields for future drive-in theaters.

The atom had come to the

POPULAR MECHANICS

MAY
1956

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 105 NO. 5



Security force stands eternally vigilant over huge atomic plant. Cloud of vapor rises night and day

Look What Happens When THE ATOM STRIKES A VALLEY

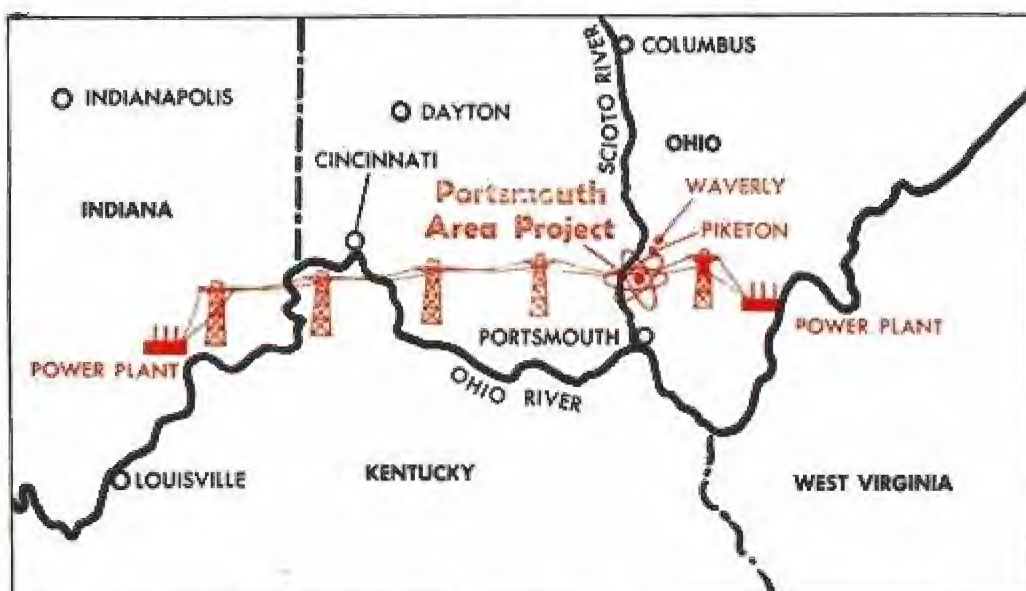
By
Clifford B. Hicks

Post-construction sale brought thousands who bid on items from houses to tools

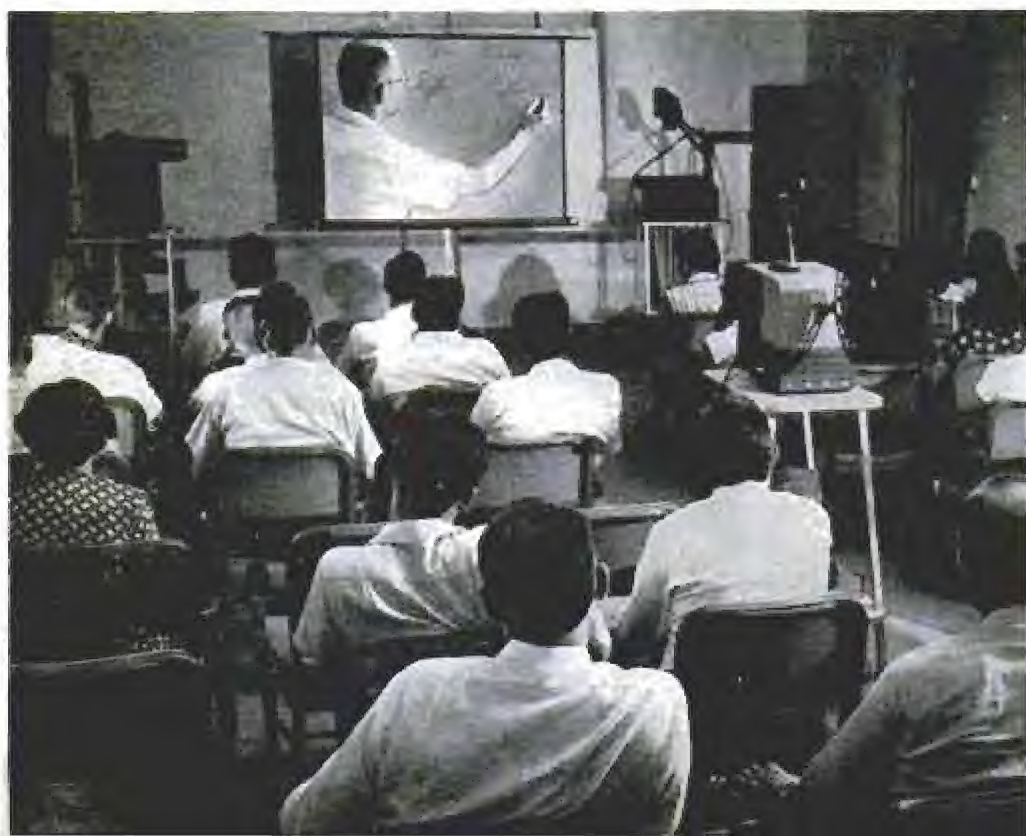




Old farm buildings in foreground stand in sharp contrast to atomic plant that sprawls across 3700 acres



Map shows location of project, the power plant and towns of Waverly and Piketon, most affected by boom. Below, atomic workers attend class



Scioto River Valley, and was threatening it with a human flood. Today the local citizens are still feeling the backwash, and things will never be quite the same in the placid valley again.

Industrial Explosion

The story of the atom and the Scioto Valley is the story of a small area that suddenly finds itself in the middle of an industrial explosion. It's a story that may be repeated elsewhere as the atom becomes a big peacetime business, or as other big industries suddenly expand into rural areas.

It's the story, too, of one of the biggest industrial projects ever undertaken in the United States. The existence of the Portsmouth Area Project is no secret, but relatively few Americans have ever heard of it. They should. They can point to it with pride.

Back in the summer of 1952, the residents didn't quite know what was up as the speculators swarmed into the area. A few suddenly found themselves offered fantastic prices for their land. One old-time farmer snapped up \$25,000 for five acres of mediocre soil. Another grabbed off \$75,000 for a 1500-foot strip



During construction period, mysterious windowless buildings seemed to spring up on the site overnight

fronting the highway. In the little town of Waverly, right next door to the plant, an old store brought \$35,000 to its owner; he couldn't have sold it for \$5000 a week before.

Such high prices were mere tokens of what was to come before the gaseous-diffusion plant was completed. Now it has gone into full production and it's a sight to see, though of course you can't get inside the chain-link and barbed-wire fence that stretches more than four miles around the perimeter. But you can see vast windowless buildings that give you a vague notion of the size of your investment as a taxpayer.

There are about 220 acres of floor space in this incredible atomic factory—enough to accommodate 166 football games going on simultaneously! If you assembled all the engineering drawings for this intricate

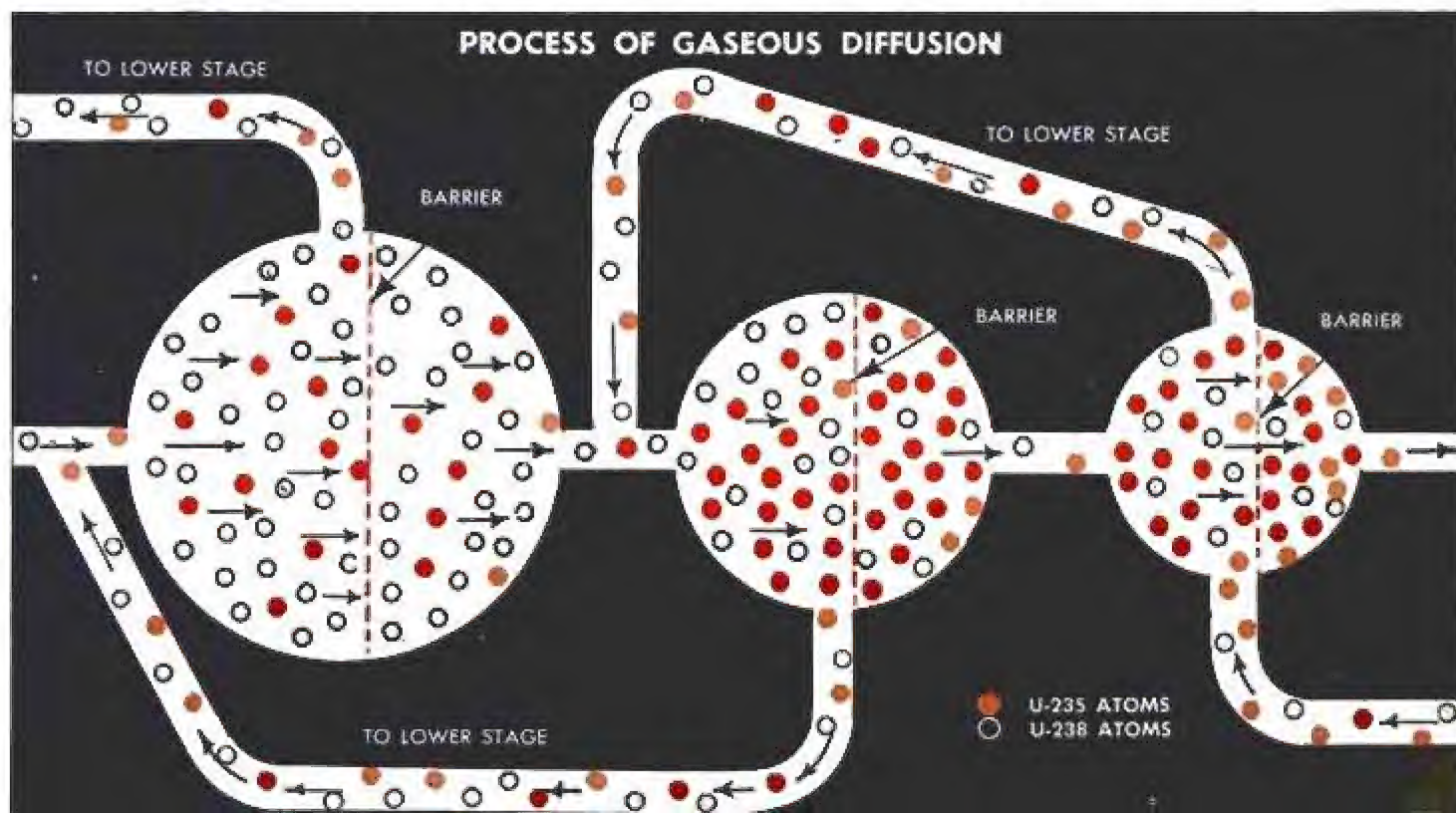
plant they would cover $2\frac{1}{2}$ acres of land. A whopping 9,000,000 cubic yards of dirt were excavated for the buildings, which soaked up 525,000 cubic yards of concrete, 30,000 tons of reinforcing steel, 1600 miles of pipe and tubing, 2,500,000 sacks of cement and some 4600 miles of electrical wiring.

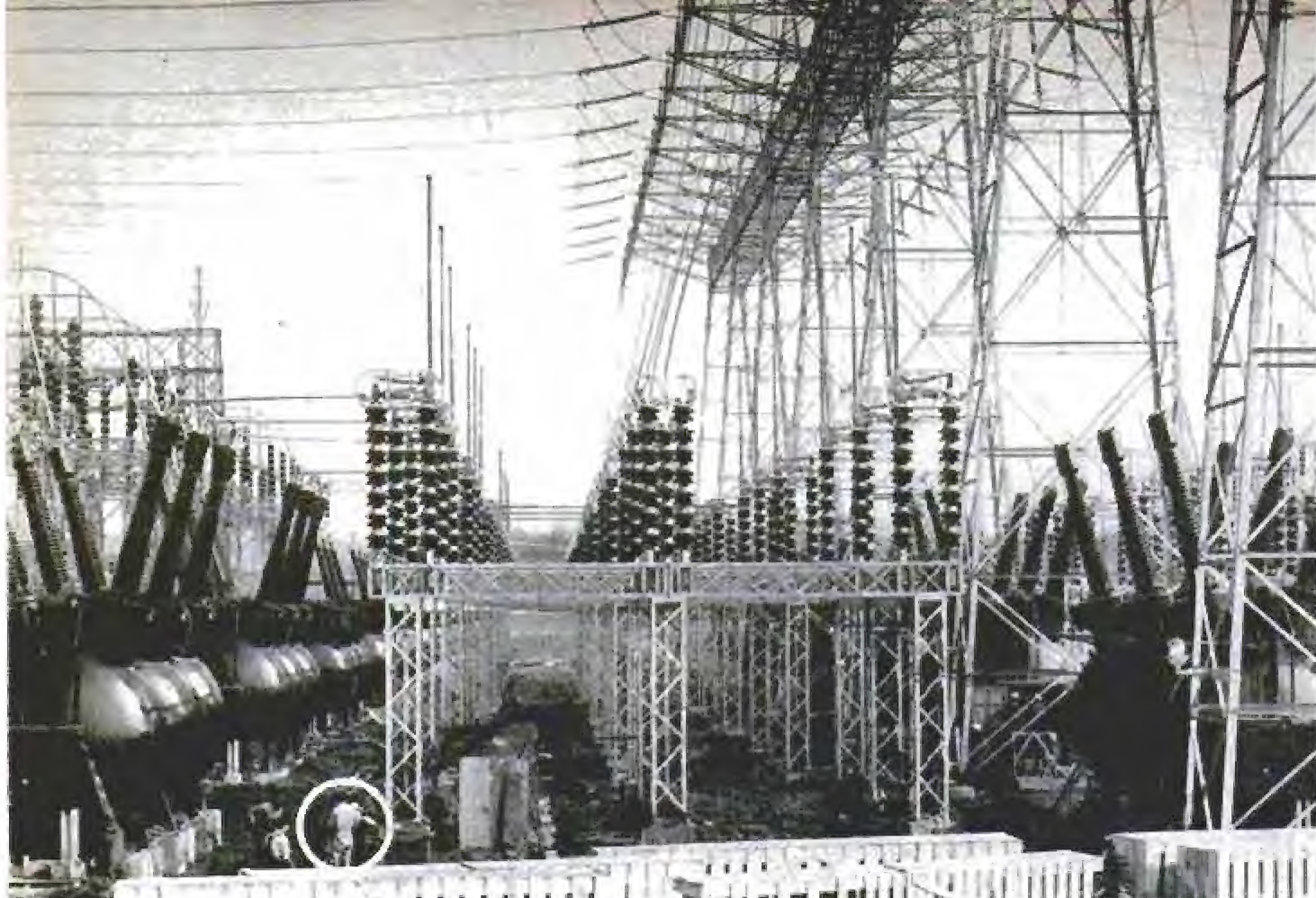
About 120,000,000 man-hours of work, sweat and worry went into the project, enough to keep one man busy on a 40-hour week for 57,692 years. It's essentially an automated factory operated by about 87,000 instruments. Each day some 350,000,000 gallons of water surge through the plant.

Plant Sifts Atoms

These incredible figures seem even more incongruous when the purpose of this new

Schematic diagram shows how U-235 atoms penetrate barriers faster than U-238 to produce enriched gas





Project requires a tremendous supply of electricity, brought in to this terminal area. Note size of man

factory is considered. Night and day it sifts invisible atoms into two stacks.

U-235 atoms are what make the atomic program go 'round. They keep the *Nautilus* under way, explode atomic bombs and are the fuel of peacetime reactors. Uranium, as found in nature, contains only one U-235 atom for every 140 atoms of U-238. The two isotopes are identical except for an incredibly slight difference in weight. The mysterious plant simply sorts out these two types of atoms.

Uranium Becomes Gas

Uranium as it is used in the plant is combined with fluorine to make a gas, which then is pumped through countless miles of piping. At intervals it must pass through

barriers which contain literally billions of holes, each less than $\frac{3}{1,000,000}$ inch in diameter. All atoms can easily pass through these holes, but the U-235 atoms, being slightly lighter, move just a bit faster, and therefore tend to pass through the holes first. As the gas pours through thousands of these barriers it becomes more and more enriched in U-235 atoms until it is highly concentrated and becomes the basic stuff of atomic science.

Back in the summer of 1952 there was no hint that this process of sifting the invisible would be done in Pike County. Then the AEC made its announcement and immediately arranged to buy 3700 acres of farm fields, wooded hills and yellow clay. On this large tract of land were about 40 farm

Hundreds of temporary "flattops" housed workers. In backwash of boom, some sold for \$350 including utilities





Some 20,000 new workers—plus their families—invaded the area. Here one shift files through time-clock gates

families, one church and two cemeteries.

Everything seemed to happen at once. The AEC entered into a contract with Goodyear Tire & Rubber Company to operate the nonexistent plant. Goodyear formed the Goodyear Atomic Corporation (GAT), pulled in a cadre of key men from all over the world and sent them to Oak Ridge to learn how to sift atoms. Eventually these men arrived at the Portsmouth site and started recruiting workers. The recruits then went through a school taught by men who, a few weeks before, had been attending school themselves.

Well-Planned Project

Meanwhile AEC, the construction company and GAT studied the history of the Oak Ridge and Paducah atomic installations to find out what they could expect from an industrial boom, and to make their plans accordingly. It's a fact that, despite the pinches and crises that cut tempers short, this was the best-planned project of its scope ever undertaken.

The contract to build the plant was awarded to Peter Kiewit Sons' Company, one of the largest construction firms in the country. The first real pinch came when Kiewit sent out the call for workers. Cars and house trailers started rolling in from virtually every state in the Union.

More than 20,000 workers had to be hired and roofs put over their heads. The govern-

ment agreed to arrange for 1000 permanent homes, and to move in 250 temporary homes and 750 trailers. During the next several months a total of 3700 privately owned trailers somehow were bedded down in the area.

But this housing didn't pop up overnight. Meanwhile empty rooms in private homes suddenly became valuable, rooms once

Plant has a complete building for decontamination of equipment. Spray booth washes away radioactivity





Project required 1600 miles of pipe and tubing, 4600 miles of wiring

occupied by youngsters who had been forced elsewhere to find work. There was a short period when homeowners had three or four men living in one spare bedroom, each paying \$8 to \$10 per week. Motels sprang up everywhere and were promptly inundated. In a few cases chicken coops and sheds were cleaned up and rented for \$50 to \$60 a month until something else was available. Contractors found themselves building big housing projects they wouldn't have considered a few months before. In Portsmouth alone, the value of building permits leaped from about \$1,000,000 in 1951 to almost \$5,000,000 in 1953.

Two small towns adjacent to the site had convulsive growing pains. At the time of

ing in the plant alone. And these were just workers. A good many of them moved their families to the area."

What about those families? A wave of kids poured into the school system. In the village of Beaver, five miles from the plant, youngsters attended classes in the city hall and jail. Kids left home in shifts like their fathers until the frantic residents, with the help of the U. S. Office of Education, could build some permanent schools.

Churches were jammed to the doorways. Ministers addressed congregations in trailers, houses, tents and barns. An enterprising doctor rolled a trailer into the middle of the area and started treating an overflow of patients in this "office." A dentist soon followed suit.

Stan Spalding, now editor of the *Waverly News*, worked for the construction company during those exciting, exasperating days. "When that many people suddenly move into an area," says Spalding, "it's not just a matter of finding a roof to put over their heads. Seems like everything strains until it's ready to snap. Highway 23 was one big traffic jam around the clock. It took an hour and a half for a worker to drive the 22 miles from Portsmouth to the plant. This stretch of highway was widened to four lanes as fast as possible, and a huge cloverleaf and access

(Continued to page 244)



New houses sprang up by hundreds in nearby towns. Now many are vacant

Lock Inside Refrigerator Prevents Accidents

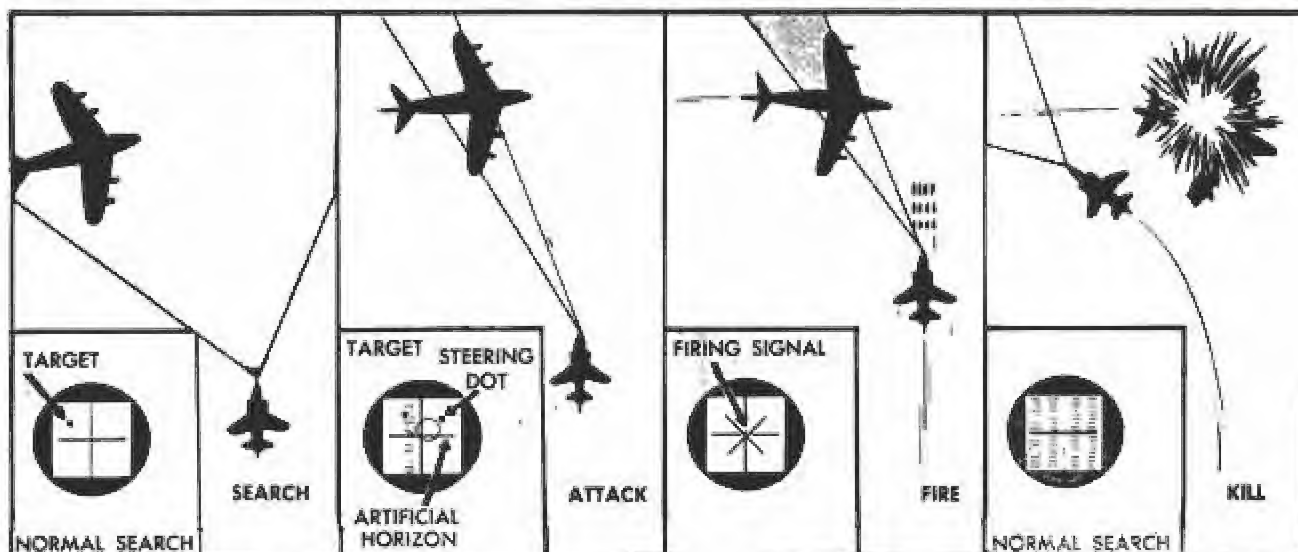
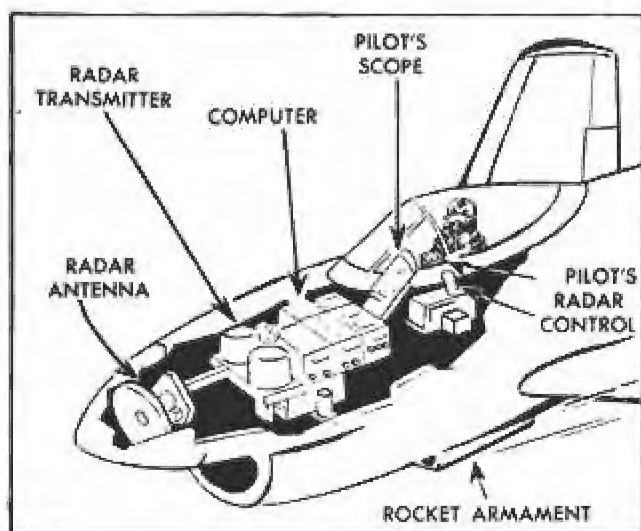
Concerned over the rising number of fatalities resulting from children crawling into abandoned refrigerators and being locked in, the Admiral Corporation is building a lock-release inside of its new line of refrigerators. The release glows in the dark, and all a child has to do to open the door is to touch the glowing button. Since an estimated two to three million refrigerators go out of service each year, the potential danger to children is great. In 1955, 18 youngsters suffocated inside abandoned refrigerators—18 lives which might have been saved by lock releases.



Interceptors Seek, Find and Kill Enemy Electronically

Every interceptor plane, both American and Canadian, now guarding the North American continent is equipped with a "seek, find and kill" radar system operated by an electronic brain. Dispatched by ground radar, the pilot flies to within 15 miles of approaching enemy bombers. Then he turns on his automatic gear. The plane's

radar seeks out the enemy and the brain flies the plane into firing position. It computes aim for rockets, fires them at the right moment and then pulls the interceptor up and away from target debris. The system has as many parts as 200 television sets, can operate effectively day and night and in all kinds of weather.





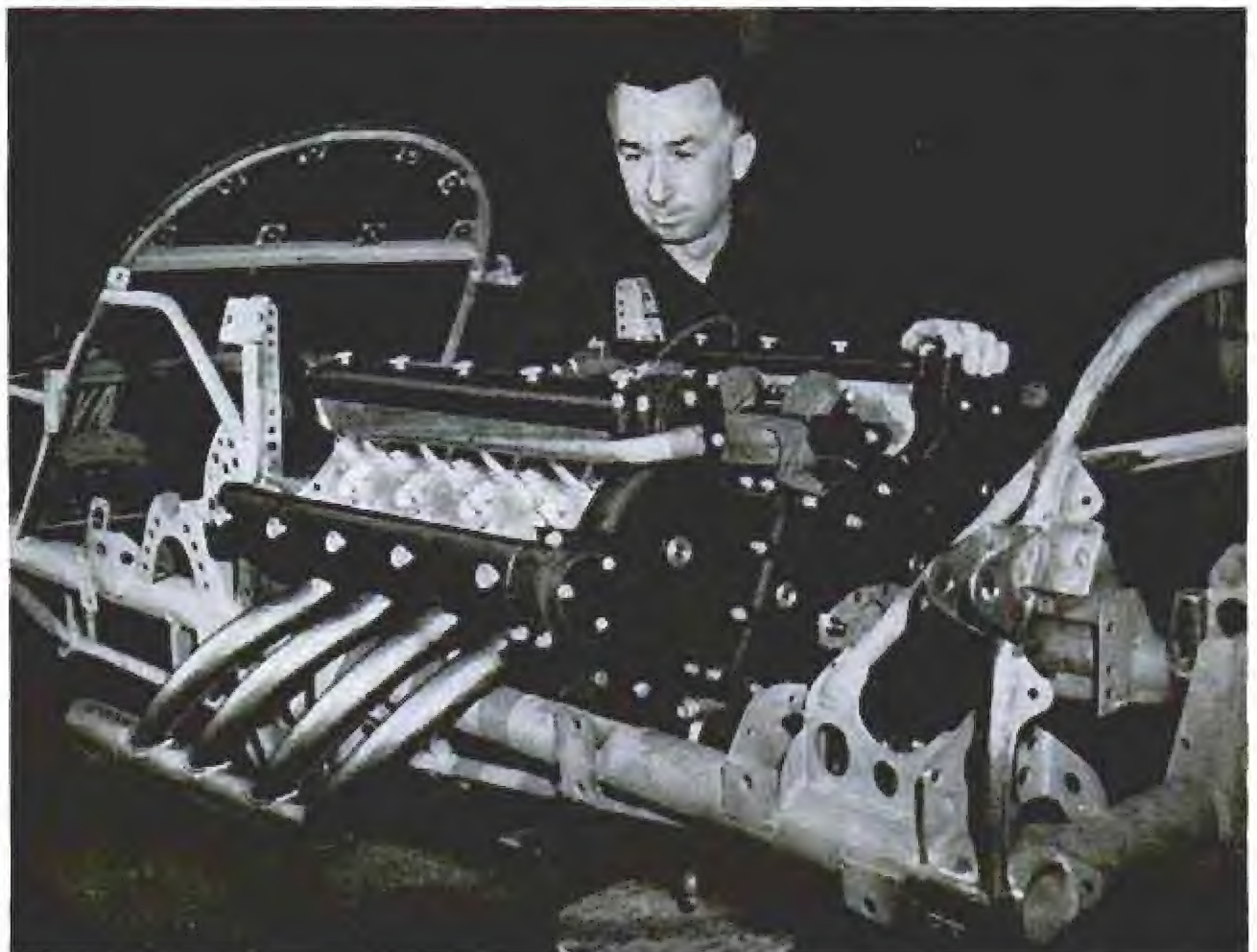
What Will it Take to Win At Indianapolis?

WHICH CAR will win the "500" this year? It's a good bet it will be a Kurtis "500" roadster powered by a four-cylinder Meyer-Drake engine that has a 13:1 (or higher) compression and burns straight alcohol.

That's a good bet if you are a form player and like the favorite.

Experts agree the winner is likely to be a roadster designed for the 500 (not a dual-purpose car that races dirt tracks, too); it should weigh about 1800 pounds; it should

New this year is the 405-hp. Hopkins V8 which is built up from a Studebaker block and uses Cadillac rods



have a dependable, powerful engine offset four to seven inches to the left (putting more weight inside the counterclockwise corners); it should have fuel injection and it should have more power rather than more streamlining.

But not everybody plays according to form. One persistent nonform player is Lou Welch, owner of the high-powered, low-lucked Novi V8s, which have set qualifying records but have never won.

After 10 winless years with front-wheel drive, Welch has switched to rear drive and has installed his supercharged Novi V8s in two Kurtis-built roadsters. The reworked engines develop well over 600 horsepower (compared to 330 of the Meyer-Drake engines).

Another nonform player is Lindsey Hopkins who plans to enter a 405-horsepower fuel-injection V8 built up from a Studebaker block.

Expected again this year (it didn't make it in 1955) is a 400-horsepower Ferrari six-cylinder engine in a Kurtis chassis.

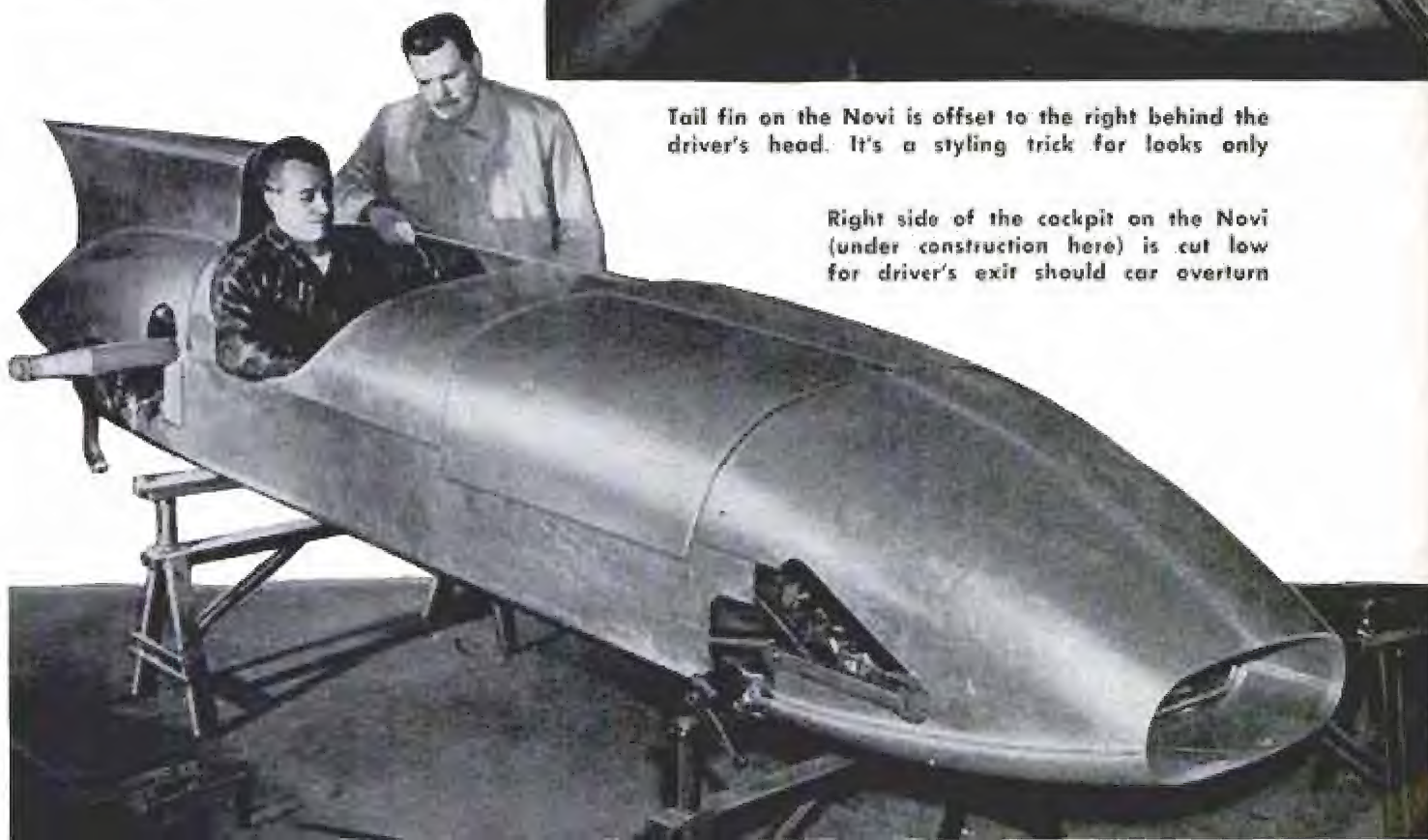
More than half the track has been resurfaced to eliminate ripples on the turns. Qualifying speeds are expected to be about 1.5 miles per hour faster than in 1955. Race speeds should set a record, barring rain, accident or any of the unpredictable occurrences that make predictions by anyone (expert or otherwise) unreliable. ★ ★ ★



Rear view of new Novi which is rear-wheel drive this year. Ring-gear housing is offset to the left to line up with engine



Tail fin on the Novi is offset to the right behind the driver's head. It's a styling trick for looks only



Right side of the cockpit on the Novi (under construction here) is cut low for driver's exit should car overturn



Rear view of the instrument. Evapograph picture of parked auto accents warm fires and hot area around engine

Camera Photographs in the Dark With Heat Rays From Subject

Pictures are taken in complete darkness by a camera that employs the infrared rays emitted by a faintly warm object. The heat rays are focused on the photographic plate by a concave mirror like a telescope's. The plate itself is a narrow plastic membrane coated with a thin film of oil. As the oil evaporates under influence of radiation, an image emerges, with different colors in the

oil denoting minute differences in the heat emitted. The camera may see use in charting hot spots in electronic apparatus, spotting flaws in hot metal parts and may even be able to spot tumors in the human body that cause a temperature rise in certain parts of the skin. The camera, known as the Evapograph, can "see" objects as far as a mile away.

Doctor's Medical Kit Carried in Pocket

Having been caught more than once in an emergency without his black bag, a Chicago physician has invented a lightweight medical kit that can be carried like a bill-fold in the hip pocket. The kit contains essential diagnostic instruments, therapeutic equipment and medications. The secret of its compact size is the facility for combining two instruments to make a third.



Four-Wheel Cycle Mounts "Trunk"

By combining bicycle and tricycle parts, C. A. Cole of Graham, Ala., has made a four-wheel vehicle with plenty of cargo space in the "trunk." An extra-wide handle bar makes turning easy. The vehicle is pedaled like a regular bicycle and stopped with a coaster brake.





Fast-Acting Jet Starter Tows Plane to Take-Off Spot

Jet planes are started in 14 seconds instead of 50 seconds with a unit that takes its power directly from a gasoline engine through a hydraulic torque converter. The low-slung wheeled unit, which looks like an Indianapolis racer, can drive directly under a jet to start it, then tow the plane to take-off position. It is designed to replace the much slower and more expensive air-turbine-type starters which require electrical outlets and produce a high-pitched whine. The new starter has a four-wheel drive, four-wheel steering and provides 28-volt direct current and 400-cycle alternating current for the plane. It is

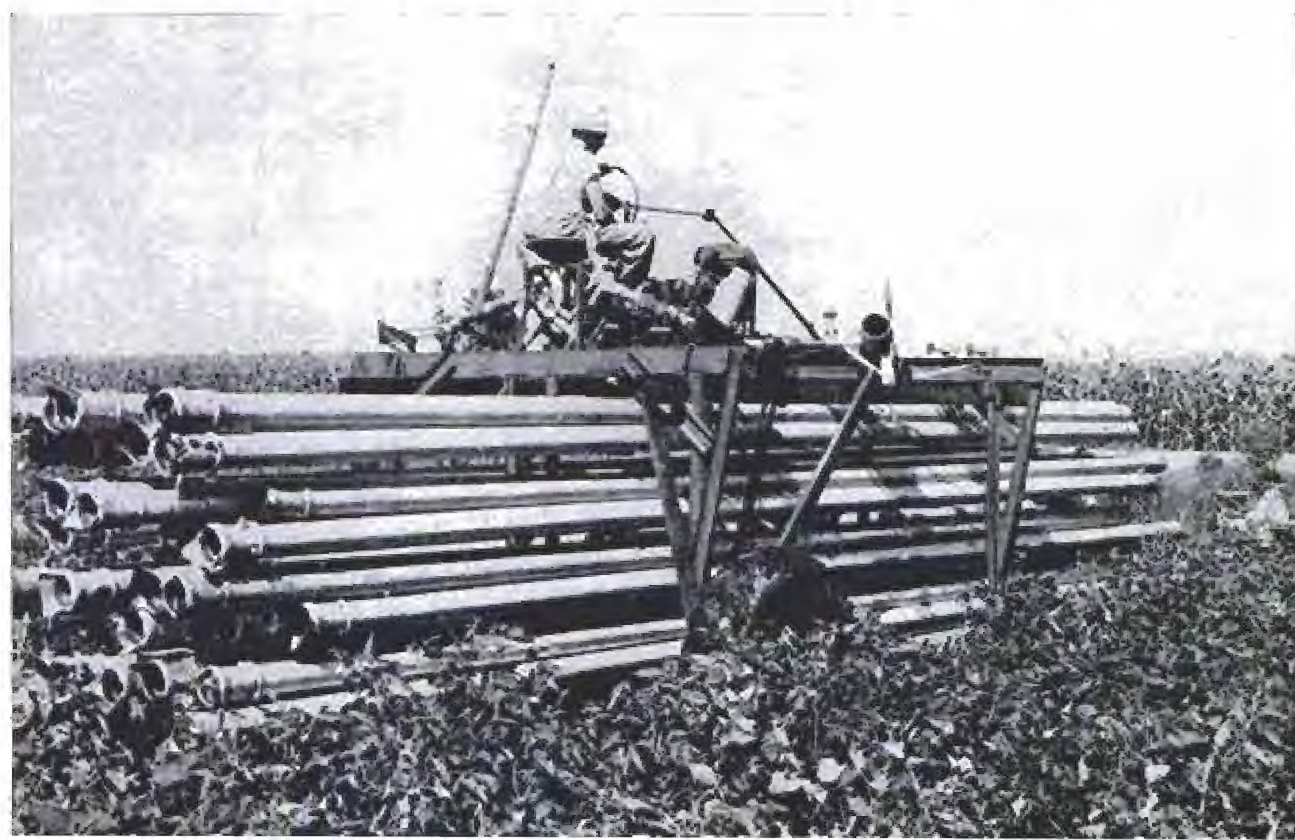


powered by a standard automobile engine and uses many stock automotive parts. The 3500-pound unit has a chassis of tubular steel with torsion-bar suspension, a 160-inch turning radius, and is only 30 inches high, 144 inches long and 65 inches wide.

Pipe Carrier Loads or Unloads as It Travels Down the Row

Irrigation pipe can be picked up or laid down in a field of tall corn with a self-propelled carrier built by Clarence Koselke

of Wanatah, Ind. It straddles two rows of corn, loading or unloading as it goes. It is shown here in a soybean field.



Best-Liked Features

Handling

"I like the way it handles on long trips. Easy to park. I can see both rear fenders."

VIRGINIA MEAT CUTTER

49.0% V8 Owners
40.9% Six Owners

Performance, Power

"Outperforms any car I have ever driven. Fast pickup. On trip to Oregon with two adults, three children and baggage, it held 80 m.p.h. easily."

CALIFORNIA HOUSEWIFE

38.1% V8 Owners
19.3% Six Owners

Push-Button Shift

"I like the push-button shift. It is much easier. Don't have to worry about the children touching it."

NEW JERSEY TRUCK DRIVER

31.6% V8 Owners
34.8% Six Owners

Riding Comfort

"Driving is easy, pleasant, comfortable. Easy to get in and out. Tasteful interior is roomy, quiet."

NEW YORK HOUSEWIFE

33.2% V8 Owners
31.3% Six Owners



Most-Frequent Complaints

Poor Gas Mileage

"Gas mileage poor. I average only 13 miles per gallon. This is poor considering size of car."

INDIANA INSURANCE ADJUSTER

17.8% V8 Owners
5.5% Six Owners

Dashboard Design

"Don't like lights for oil and amperes. Lighter, ash tray and heater controls too far from driver."

CONNECTICUT TECHNICIAN

14.4% V8 Owners
8.6% Six Owners

Battery Troubles

"Batteries in new Plymouths are no good. I have had a dead battery three times in two months."

PENNSYLVANIA SECRETARY

4.5% V8 Owners
5.2% Six Owners

Rattles, Squeaks

"Body could be tighter. Seems to have a number of small rattles."

WISCONSIN SALESMAN

13.4% V8 Owners
7.0% Six Owners

OWNERS REPORT:



THE WORLD'S LONGEST ROAD TEST: 2,265,758 MILES!
Equal to 90 trips around the earth. That's how many owner-driven miles are behind this frank account of

What Owners Think of the Plymouth

As Told By the Owners Themselves

MILLIONS OF MILES—that's how long this owners' road test of the 1956 Plymouth is, making it the longest road test we have ever printed!

Total mileage on the Plymouths in the Report is 2,265,758 miles. In that much driving just about everything about a car, good and bad, will come to light.

"Its beauty and lines get many admiring glances."—Florida therapist.

"Different in styling from any other car."—Pennsylvania mill worker.

First, let's look at some of the good points. Owners of the 1956 Plymouth really like its styling, especially the tail fins.

"Jet-age styling makes it look like 'GO'."—Florida inspector.

"Tail fins give it a new-car look. Other new cars appear to be '55 models with some chrome added."—California bookkeeper.

But there are some who have reservations about the new "jet era" styling.

"Fins look good, but I'm always bumping

(Continued to page 95)



CLYMER TESTS THE 1956 PLYMOUTH

By Floyd Clymer

PLYMOUTH'S new push-button shift is a fascinating gadget, although a little time is required to get accustomed to it. I like it. What happens if you push the wrong button? An interlock device throws the car into neutral automatically if you push the reverse button at speeds above 10 miles per hour. You must push the button all the way in to engage it properly. Alternate operation of Low and Reverse is possible and you can do this very fast—a

good feature for rocking the car in mud or snow.

After a short time I was shifting by touch and not by sight. Shifting is faster by this method. The buttons have dim lighting for night use and are clearly marked. There is no parking-lock position.

My 965-mile test of the Belvedere V8 two-door hardtop was from Los Angeles to San Francisco and return via Reno, Nev.,

(Continued to page 272)

An Engineer Analyzes the Plymouth V8 With Power Pack

By Dale Kelly, SAE

Model tested: Belvedere four-door sedan with PowerFlite automatic transmission, power brakes and steering, and an extra-cost power pack consisting of a four-barrel carburetor and dual ex-

hausts. Weight: 3675 pounds with gas tank half full (56 percent on front wheels, 44 percent on rear). Rear-axle ratio: 3.54 to 1 (measured). Wheelbase (measured): 114.5 inches left, 115.0 inches right.

ACCELERATION



TIME IN SECONDS	0-20	0-40	0-60	0-80	1/4 mile
Ignition timed for regular gasoline	2.8	7.4	13.3	28	19.8
Ignition timed for premium gasoline	2.8	7.1	13.3	28	19.8

(The watch was started at the instant the accelerator was floored. The engine was not run up against the brakes before the start. All tests were in Drive range.)

FUEL ECONOMY



MILES PER GALLON	Steady 30 m.p.h.	Steady 50 m.p.h.	Steady 70 m.p.h.	Traffic Route
Ignition timed for regular gasoline	20.7	16.0	13.7	9.5
Ignition timed for premium gasoline	20.8	15.9	13.7	9.0

(On traffic route, car makes 10 full stops per mile and is driven at speeds fast enough to average 15 miles per hour over-all.)

ESTIMATED ANNUAL GASOLINE BILL: \$182 for 10,000 miles. Based on 2000 miles at 30 m.p.h., 5000 miles at 50 m.p.h., 1500 miles at 70 m.p.h. and 1500 miles in traffic, and on the exclusive use of regular gasoline at 27 cents a gallon.

SPEEDOMETER ERROR



MILES PER HOUR	30.0	40.0	50.0	60.0	70.0	80.0
Indicated speed	30.0	40.0	50.0	60.0	70.0	80.0
True speed	30.0	38.5	47.0	56.0	65.0	73.0

ODOMETER ERROR:

The odometer indicated 3.5 percent more than the actual distance traveled or 103.5 miles for an actual 100.

DRIVER'S VISION



Some portion of the road could be seen 13 feet in front of the car (A in sketch) by an average driver (5 feet 9 inches tall); full width of the road could be seen 19 feet in front of the car (B in sketch).

GROUND CLEARANCE



With no passenger load, the ground clearance was 6 3/4 inches at the oil pan and 6 1/4 inches at the steering linkage. The car consequently dragged when driven in ruts that do not bother most other cars.

The low corner of the rear overhang would drag if the car were driven up an incline whose profile had a radius of curvature of less than 27 feet (solid line in sketch). The center of the car would clear a circular hump with a radius of 18 feet or more (dotted line). Doors will open over an 11-inch curb.

MISCELLANEOUS

Octane requirement: Ignition timing had to be retarded to three degrees after top dead center for knock-free operation on an 85-percent octane blend of octane and heptane, equivalent to typical regular gasoline (octane 82 Motor, 88 Research). Acceleration and gasoline-mileage data listed above for regular gasoline were obtained at this setting.

The best acceleration from standstill to 45 miles per hour was obtained with the ignition advanced to two degrees before dead center. The acceleration and gasoline-mileage data listed above for premium gasoline were obtained at this setting.

Ignition could be advanced another degree (to three degrees before dead center) before there was any knocking on a 90-percent octane blend of octane and heptane, equivalent to a typical premium gasoline (octane 85 Motor, 95 Research).

The test results show that this car, with a 4000-mile accumulation of carbon, was able to deliver peak performance on typical regular gasoline. Another car of the same model may, however, have an octane requirement several points higher or lower.

Steering: From straight ahead, the steering wheel had to be turned 0.7 revolution to make the outside of the outer front wheel travel in a circle with a radius of 50 feet. The steering wheel made 3.75 turns, lock to lock. Turning-circle diameter, curb to curb, was 41.0 feet; from wall to wall, 43.6 feet. Steering-wheel diameter: 17.5 inches.

Trunk capacity: In addition to spare tire and tools, the trunk could accommodate 14 cardboard cartons of the size used for 48 tall cans of evaporated milk. Since this car was not air-conditioned, there was no evaporator to use up trunk space.

Gasoline fill rate: Fuel tank could be filled at better than 14 gallons per minute when almost empty. No filling-station pump used in the test could pump faster than the inlet pipe could take it.

Interior sound level: Sound level inside the car was 93 decibels at 40 m.p.h. and 94 decibels at 60 on a smooth road with all windows closed.

Water resistance: Car was washed in an automatic high-pressure car wash and driven through a standard splash pan. In the wash test a few drops of water got past the door seals and a few ounces got into the trunk. In the splash pan no water entered the car. In neither test were brakes or ignition affected.

Center of gravity: Center of gravity of the unloaded car was 23.5 inches above the ground.

Brakes: Hand brake and foot brakes worked well. The hand brake held the car on a 14-percent grade. It works on the drive shaft and is therefore ineffective when either rear wheel is off the ground (as when a rear tire is being changed). The pressure required by the foot-brake pedal was very light with engine vacuum assist and moderate with the engine not running. There was a vacuum-reserve tank with enough capacity for one or two brake applications with the engine not running.

Observations: Water-temperature gauge was inaccurate. It still registered in the normal band when the engine was hot enough to open the radiator pressure cap.

On the car tested there was a light leak from the transmission push-button panel. At night this shone directly into the eyes of one test driver.

The taillights in the rear fenders project back to within an inch of a line extending vertically upward from the rear bumpers. If the car were maneuvered close to a wall on uneven ground the taillights could strike the wall before the rear bumper.

Total mileage on Plymouths in survey is an amazing 2,265,758 miles! Owners live in 21 states (color)

The Owners Analyze The 1956 Plymouth V8

OVER-ALL RATING OF THE V8

Excellent	73.3%
Average	22.7%
Poor	4.0%



Had trouble with engine?

No trouble.....	80.2%
Some trouble.....	14.9%
Considerable trouble.....	4.9%

What was engine trouble?

Carburetion, fuel system....	5.9%
Noisy engine.....	5.0%
Battery trouble.....	3.0%
Ignition trouble.....	2.5%
Oil, water leaks.....	2.5%
Frequent stalling	2.0%

Is push-button shift convenient?

Yes	97.9%
No	2.1%

(Asked only of Powerflite owners)

Did styling influence your choice?

Yes, styling important.....	60.9%
No, styling not important....	34.7%
Undecided	4.4%

Do you like tail fins?

Yes, like them.....	91.1%
No, don't like them.....	5.4%
Undecided	3.5%

Would buy a Plymouth next time?

Yes, would.....	57.4%
Might	35.2%
No, would not.....	7.4%

Best-Liked Features

Handling ease.....	49.0%
Performance, power.....	38.1%
Comfort of ride.....	33.2%
Push-button shift.....	31.6%
Exterior styling.....	30.2%
Economy of operation.....	7.9%
Interior styling.....	7.9%
Vision	4.9%

Most-Frequent Complaints

No complaints at all.....	32.7%
Poor gas mileage.....	17.8%
Dash design, arrangement....	14.4%
Rattles, squeaks.....	13.4%
Engine rough.....	7.9%
Poorly assembled.....	7.4%
Water leaks.....	5.4%
Battery trouble.....	4.5%

Why Did They Buy Plymouth?

Exterior styling.....	23.3%
Previous experience.....	14.9%
Push-button shift.....	10.4%
Price	5.0%
Comfort of ride.....	4.5%
Handling ease.....	4.5%

The Owners Rate Plymouth Dealers

How is dealer service?

Excellent	50.7%
Average	33.3%
Poor	16.0%

Would buy from him again?

Yes, would again.....	71.5%
No, would not.....	19.5%
Undecided	9.0%

What make car was traded?

Plymouth traded.....	40.8%
Other Chrysler product.....	8.9%
Non-Chrysler product.....	32.6%
No trade, no answer.....	17.7%

Trade-in allowance on Plymouths

Above average.....	38.9%
Average	57.3%
Below average.....	3.8%

Trade-in allowance other makes

Above average.....	39.1%
Average	53.5%
Below average.....	7.4%

The Owners Analyze The 1956 Plymouth Six

OVER-ALL RATING OF THE SIX

Excellent	64.3%
Average	31.5%
Poor	4.2%

Had trouble with engine?

No trouble.....	80.1%
Some trouble.....	16.7%
Considerable trouble.....	3.2%

What was engine trouble?

Hard to start.....	4.4%
Frequent stalling.....	3.4%
Skips, bucks.....	2.3%
Carburetor trouble.....	2.1%
Automatic choke.....	1.3%

Is push-button shift convenient?

Yes	98.7%
No	1.3%

(Asked only of Powerflite owners)

Did styling influence your choice?

Yes, styling important.....	54.4%
No, styling not important....	40.9%
Undecided	4.7%

Do you like tail fins?

Yes, like them.....	86.2%
No, don't like them.....	10.2%
Undecided	3.6%

Would buy a Plymouth next time?

Yes, would	57.8%
Might	35.7%
No, would not.....	6.5%

Best-Liked Features

Handling ease.....	40.9%
Push-button shift.....	34.8%
Comfortable ride.....	31.3%
Exterior styling.....	29.7%

Economy of operation.....	22.7%
Power, performance.....	14.3%
Vision	9.1%
Dependability	7.3%

Most-Frequent Complaints

No complaints at all.....	33.9%
Dash design, arrangement....	8.6%
Rattles, squeaks.....	7.0%
Poor gas mileage.....	5.5%
Battery trouble.....	5.2%
Transmission	4.9%
Body leaks.....	4.9%
Poor assembly.....	4.9%
Noisy engine.....	4.2%

Why Did They Buy Plymouth?

Exterior styling.....	23.4%
Previous experience.....	21.4%
Economy of operation.....	8.3%
Push-button shift.....	8.1%
Best deal.....	4.9%
Price	4.9%

myself on them when walking around rear of car."—Wisconsin civil servant.

"Tail fins too obtrusive. Out of harmony with rest of design."—California manager.

"Purpose of a car is transportation and the tail fins add nothing to this."—Maryland lawyer.

Approve Push Buttons

Another innovation this year on Plym-

outh is push-button control of the automatic transmission. Rarely, if ever, has such a new departure been accepted with so much enthusiasm. When you realize that the control panel is on the left of the dash and requires left-hand operation, a complete departure from the standard of years, it is unbelievable that acceptance could be so complete. Almost 100 percent of the owners who have it like the push-button



Like many cars, Plymouth has a long overhang that may damage tail pipe on steep incline like garage ramp, above. Photo below shows how little clearance there is as car descends the ramp



Owners rave about push buttons (left), but don't like indicator lights (center) or distant location of heater controls (right)



control (the actual percentage was 98.2 percent).

"Push-button drive is much easier to operate. I don't have to worry about children handling it."—New Jersey truck driver.

"Push buttons are away from my two small boys who play on the right side."—Maryland salesman.

"Transmission on the left is great on a date or in a crowded car."—Maryland high-school student.

"Push-button drive is very good for rocking the car in deep snow."—Washington engineer.

There are a few owners with reservations.

"It is possible to push a button in and have it come out again so you can't tell what range you are in."—Maryland machine operator.

"I have to reach too far to shift with push buttons."—Illinois assembler.

What Should Be Changed?

Although about 40 percent of the Plymouth owners state that nothing needs to be changed on their cars, the other 60 percent don't agree. The most frequently mentioned change involves the dashboard and location of controls and conveniences.

"Should mount heater controls on the driver's side and add an ash tray for the driver."—California mechanic.

The heater controls are mounted far to the right of the dashboard, requiring a long reach by the driver to adjust.

"Occasional use of the glove compartment does not warrant its being in such a prominent position in middle of dash. It should be moved over and the heat controls put in its place."—New York sheet-metal mechanic.

"I would rather have a real oil gauge and ammeter instead of indicator lights."—Washington technician.

Handling Is Best Liked

Again this year, handling is a best-liked feature among Plymouth owners. Both V8 owners and six-cylinder owners rate the car's ease of handling as its best feature.

(Continued to page 266)



Renault's New Dauphine Introduced in Switzerland

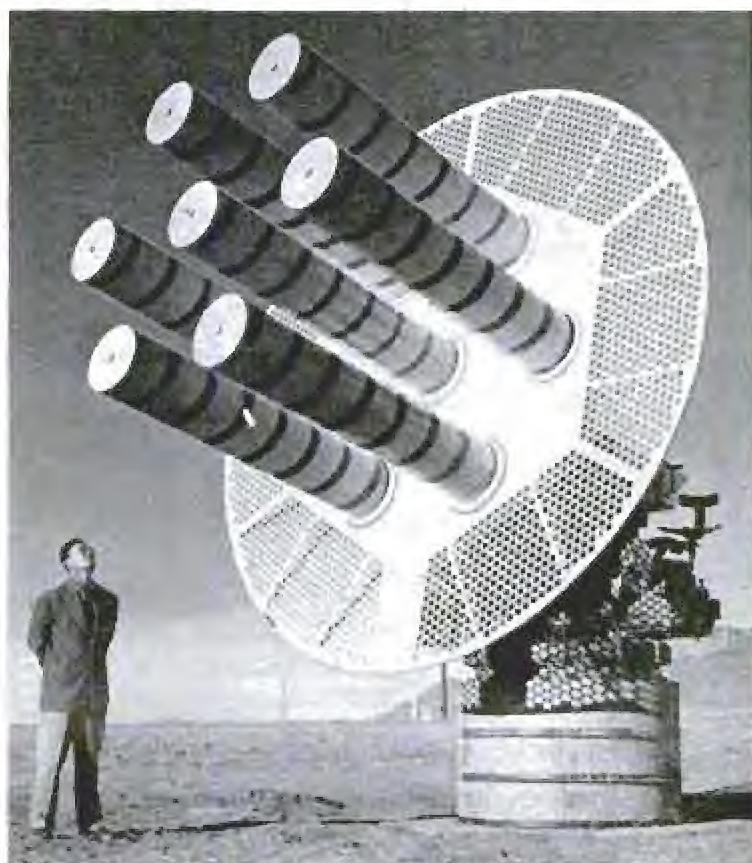
Introduced at the Geneva, Switzerland, Auto Show, the all-new Renault Dauphine is a complete departure from previous Renault styling. Still retained and identifying it as a Renault are the vertical grilles just ahead of the rear wheels through which air is taken in to cool the rear en-

gine. No specifications are available at this time, although it is known that the Dauphine has slightly more horsepower than the Renault 4CV, the model now on sale. Production plans for the new model are unannounced and they are not expected in this country until later this year.

Candy-Cane Antenna

On a desert in California stands a weird antenna sprouting seven long tubes, each of them striped like a candy cane. The special antenna is designed to pick up radio signals from aircraft, rockets and missiles which telemeter information during flight or free fall. The tubes, made of glass fiber, are 7 feet long and 18 inches in diameter. Each tube has a ribbon of copper wound spirally around it to form one element of the antenna. Signals come through the new equipment at significantly greater strength than through former telemetering antennas. The instrument is installed on a modified antiaircraft-gun mount. An automatic-tracking system keeps the array pointed at the signal source at all times.

☐ There now are 6921 civil airports in the United States, with 1216 of them lighted and 1373 paved.





Expedition plane is grounded by white-out—a weather condition during which white sky matches the snow

UNDER ANTARCTIC ICE

The Seabees Build a Town

By Richard F. Dempewolff

PM's Staff Editor With Operation Deepfreeze

PART II

IF ANTARCTICA'S THICK CRUST of glacial ice, with its mighty pressure ridges and chasms, gave trouble to the Seabee base-builders on Operation Deepfreeze, the white continent's bay ice was even

worse. Awesome ice-bound inlets, stretching like floating aprons between mountain-ringed shores and white barrier cliffs, look great for travel. They're flat and hard, with a blanket of wind-packed snow on top for traction.

But all of us soon learned that sea ice is fraught with booby traps. Great tidal cracks, or "hinge lines," fracture the surface where it joins land or barrier. Sea currents torture and score it with jagged

Food buried in snow since 1902 was found at camp of Robert Scott, a British explorer. It was still good





Airbase camp on McMurdo Sound occupies rare patch of bare ground which is swept clear of snow by wind

breaks until, from the air, it resembles a gigantic jigsaw puzzle. Then along come polar winds that drift snow over the openings, where it cements itself across the top, sealing the breaks with fragile bridges. Penguins waddle across such bridges with no strain, waving flippers as they go. But people do not—unless they wear skis—and neither do heavy vehicles. We'd barely arrived at McMurdo Sound when a group of Herb Whitney's Seabees took off across the ice on a penguin hunt. During the six-mile trek, half a dozen trail breakers tromped on solid-looking snow and plunged through to the frigid sea beneath. Friends scrambled around five feet above their heads, trying to haul them out. They came home dripping icicles.

Building a town in Antarctica is more than carpentry, masonry and glazing. Transportation of building materials from ship to site is one of the biggest problems.

The trail across McMurdo Sound to Hut Point had just been flagged last December when Herb Whitney, Vic Young and two Seabee enlisted men

started out from base camp in a Weasel, bound for the ships tied at ice edge nearly 40 miles north. Halfway, a howling wind roared down on them, drifting snow 15 feet off the ice and obscuring everything in a stinging white blanket. Within minutes, the Weasel had wandered off the trail, plunged sideways with a sudden lurch and wedged

Bobsled-trailer hauls gasoline from antarctic supply ship to airbase





Seabees test thickness of bay ice with a 20-foot motor-driven auger to make sure ice will hold heavy vehicles. Below, icebreaking USS *Glacier* cuts 30-mile channel through 15-foot bay ice so ships can get closer to camp for unloading. Bow of ship is driven up onto ice to break it



nose down in a wide crack. As sea water crept in the front, the men scrambled out an escape hatch, salvaging what few items they could—a stove, an abandoned nylon parachute and a handful of survival rations. For two miserable days, the survivors bucked zero temperatures and blizzard in a jerry-rigged parachute tent, until a helicopter could get to them. "We'd just about given up hope," Vic recalls grimly. "We huddled for warmth. Didn't dare sleep for fear of freezing." Before it could be salvaged, the Weasel slipped under the ice and disappeared.

Testing thickness of bay ice to make sure it would support big Deepfreeze vehicles, Dr. Willis Tressler, of the U.S. Hydrographic Office, tried a new tool this year—a giant motor-driven auger 20 feet long. Hauling it by sledge, Tressler and his crew worked along the trails gouging deep holes at intervals. Ice ran from 5 to 25 feet thick when offloading began. But bay ice has a nasty habit of melting—from the bottom up. Tiny marine organisms called diatoms coat the underside of all sea ice with brownish layers that absorb the sun's rays and cause warming below. From the surface it's impossible to tell that the deck under you is disappearing. Such thinning ice at McMurdo brought new disaster to the Seabees. They had just installed a Bailey bridge





Crevasse detector out front, Weasel with sled train is prepared for 400-mile trip to Marie Byrd Land

over a new crack. The first vehicle across was a lumbering 35-ton tractor piloted by Harold Williams, Seabee construction driver. Williams clanked across the span cautiously, but as his giant "Cat" thudded off the opposite side, the jar broke off a huge chunk of ice under him. It tilted crazily under the weight, as Williams and his tractor slid slowly backward into 100 fathoms of icy water. The unfortunate Seabee was last seen struggling to escape through an open door as the sea closed around him.

The long trail on endless bay ice at McMurdo plagued the entire expedition. Racing against frigid polar night, which begins to settle as the sun skids around the rim of the horizon in late February, tractors broke down, sleds bogged in drifts, perpetual storms slowed everything to a grinding halt. But it also sparked Yankee ingenuity. All kinds of vehicles were pressed into service. Even a grounded de Havilland Otter ski plane was loaded with supplies and sent taxiing at a great



Trail to Little America weaves across barrier ice filled with snow-bridged chasms. Seabees called this "Crevasse Valley"

Snocat pulls sled train loaded with tanks and lumber over the ice. Polar blizzards and white-outs were a hazard to the crews who had to keep on alert to avoid crevasses near trail





Huge "carry lifts" bogged down in snow but worked fine in areas where the snow was cleared from bay ice



Oil-burning stoves warmed tents used by Seabees at Little America. Forty degrees was considered warm. Below, laying six-mile fuel line to a "tank farm"

wobble across windswept snowdrifts on shuttle runs.

Then someone had a brainstorm. The ice-breaker *Glacier* was used to forge a 30-mile channel through the 15-foot-thick bay ice to within six miles of Hut Point base. Supplies were then swung from freighters to the expedition's three icebreakers. Acting as lighters, the breakers whammed up through the broken ice and unloaded to sled trains within sight of the growing polar town, saving days of overland hauling.

There's another way bay ice can wreck things. It disappears. In one wild day of wind and snow, more than half the entire ice mass on McMurdo Sound—an area twice the size of Los Angeles—broke up and went to sea. The same day the identical thing happened in Kainan Bay. Ships that had been moored at ice edge three miles off the barrier, suddenly were looking for a place to tie up at the formidable ice cliffs themselves. All ships dodged heaving floes. At McMurdo, the tanker *Nespelen* was caught in a squeeze that crunched her hull and spilled thousands of gallons of precious fuel across the water. A fast-working crew

(Continued to page 256)



Czech Tatra V8 Is Newly Styled

One of the world's most famous (and oldest) cars, the Tatra, has introduced a more streamlined body. The low-slung, six-passenger car is powered by an air-cooled V8 engine mounted in the rear. Top speed is over 100 miles per hour. The Tatra is made in Czechoslovakia, where it has been in production for about 60 years. The rear engine leaves the hood space free for luggage. Headlights are recessed in the grille.



Above, the Tatra, built behind the Iron Curtain in Czechoslovakia, has three headlights in its front grille. Two girls sit in the front "trunk" space to demonstrate its large capacity.



Left, newly streamlined, the Tatra T603 has a rear-mounted air-cooled V8 engine. Absence of transmission hump or tunnel for drive shaft makes it roomy enough for six. It has a four-wheel independent suspension.

Icebox Smoker

Two Oconomowoc, Wis., men have turned an old icebox into a "hot box" for the smoking of carp. The chunks of carp are placed in the top compartment. In the bottom goes a pan of wood chips on an electric hotplate. This provides the smoke and enough heat to cook the fish. The result is "tasty," say William Buckeridge and M. J. Bartelme, who are responding to an appeal made by the state conservation department to smoke and eat more carp. At present there are too many of the big fish in Wisconsin lakes and streams.

☛Two kinds of radio "signals" have been received by radio astronomers from Jupiter, the only planet in our system from which such signals have been detected. One is a sharp crackling sound like static, the other a rumble.





At San Diego, the city built a clubhouse and broad launching ramp when club members agreed to supervise them

How to Beat the— TRAFFIC JAM at the WATER'S EDGE

By Stephen Porter

A NAUTICAL traffic jam that has been building up for several years will reach a new peak of confusion and frustration during the coming boating season. But there is relief in sight—partly because the nation's 16,000,000 users of small boats of the outboard-powered variety, who created the snarl, are helping untangle it.

The bottleneck is at the water's edge. Our waterways still represent one of our last uncrowded recreational resources. But the development of means for getting boats into and out of the water has not kept pace with a growing inclination on the part of Americans to be sailors.

In warmer parts of the country the congestion is already manifesting itself. There nautical-minded citizens, with their craft, line up for blocks waiting to use their communities' meager launching facilities. This water's-edge traffic snarl soon will range northward and will be at its worst around Labor Day.

Some of the reasons can be seen in studies conducted by the Outboard Boating

Club of America, national association of boating enthusiasts and manufacturers and sellers of boating equipment.

The association's surveys show that today there are some 4,170,000 outboard motors in use, most of them by families, as compared with only 761,000, most of them by fishermen, in 1941. Not everyone who owns a motor owns a boat (some, who use their motors only on vacations, rent boats at resorts) but there are at least 2,500,000 boats in use designed for outboard power.

Half-Million Trailers

And then there is the mass-produced, factory-built boat trailer. There was no such thing prior to 1939, when the first company in the business turned out 1000 units. By 1947 fewer than 4000 had been produced. Now several dozen manufacturers are selling an estimated total of 150,000 annually, and by the height of the 1956 boating season there should be about half a million of them on the road. In addition, there are many home-built jobs.

The boat-motor-trailer package has brought into being an amphibious breed of boater, composed largely of persons who 10 years ago would have considered boating a rich man's sport and who would have thought of the outboard as strictly a fishing instrument, not suited for such family activities as cruising and week-end picnicking. The new yachtsmen usually "dock" their trailer-borne craft at home in back yards and garages. The traffic jam that results when they try to put their boats in the water stands to get worse before it gets better.

Members of a new kind of "yacht club," composed of owners of outboard craft, are beginning, however, to make some progress towards alleviating the crowding by working with their community governments and local marine dealers, or assuming the responsibility themselves.

City Foots the Bill

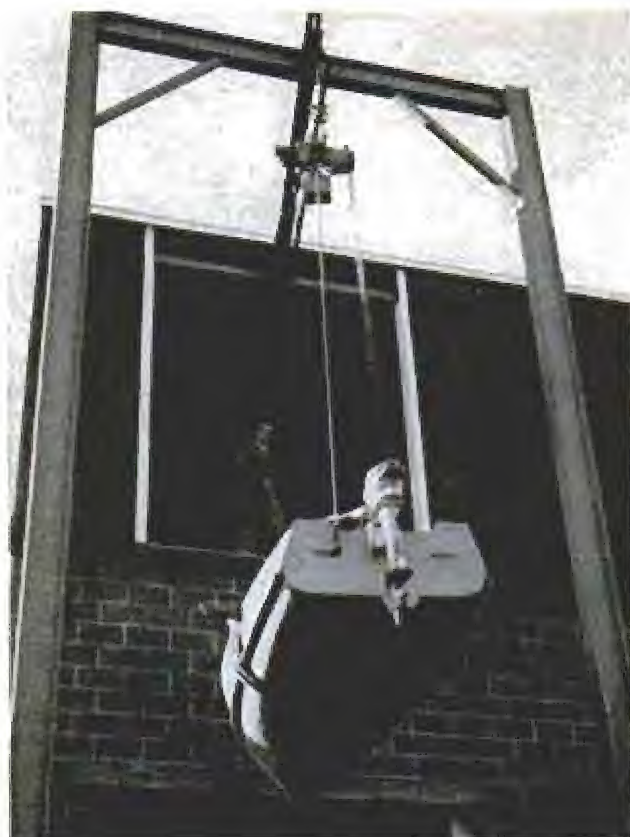
In California, the San Diego Outboard Boating Club this season will be using clubhouse facilities valued at \$16,000 and a \$3000 concrete launching ramp. The city's Harbor Department, which constructed the installation and footed the bill, is convinced it has made a money-saving deal.

The arrangement was that the city would undertake the initial costs if club members would take over the operation, including policing the area, maintaining control of the ramp to enforce safety



At one marina, a derrick hoists each boat out of water and eases it onto a lift truck. The truck then totes it over to one of several racks, below, and slips it into proper tier





Hoist lifts boats to the second floor of this boathouse, where there are repair and storage facilities

procedures and providing help for boaters.

A city official commented recently that "to hire the necessary personnel trained to render the services performed gratis by members of the club, the Harbor Department would have to spend perhaps \$10,000 annually in wages and other costs." In short, the city made a long-term investment of around \$19,000, but the outlay is being paid back, in public service, at the rate of \$10,000 a year.

The Greater Little Rock (Ark.) Boat Club has created a home for itself on a lake near the city, largely as the result of the work of women members. The female sailors staged pie suppers, raffles and chicken dinners to build up a club-facilities fund. Land was leased and then the women pitched in with the men to clear the site and build a concrete launching ramp, floating docks, a judges' stand for competitive events and a playground for small fry.

Members of the Walla Walla (Wash.) Boat Club call themselves "sagebrush sailors" because their center of boating activity is 30 miles from home in an area marked until late in 1953 by the barren sand and rock walls of the Columbia River gorge. They exemplify how the boating population is being increased in areas where arid or semiarid conditions prevailed until a few years ago—and the ingenuity displayed by today's yachtsmen.

Floating Clubhouse

What put this club in business was the building of McNary Dam, which formed a 70-mile-long lake over parts of the Columbia and lower Snake. The Walla Walla organization had its troubles in establishing an operational headquarters. The solution was found in acquiring the use of what had been a two-decker floating dormitory for the survey crew engaged in building the dam. Now the club has a base for family cruises on the lake as well as fishing expeditions on a stretch of water below the dam, where steelhead trout abound. To reach the fishing grounds from their clubhouse, club members descend 92 feet through a navigation-lock chamber that is 86 feet wide and 675 feet long.

Elaborate yacht clubs have built complete facilities for the outboard boaters as well as cruiser owners



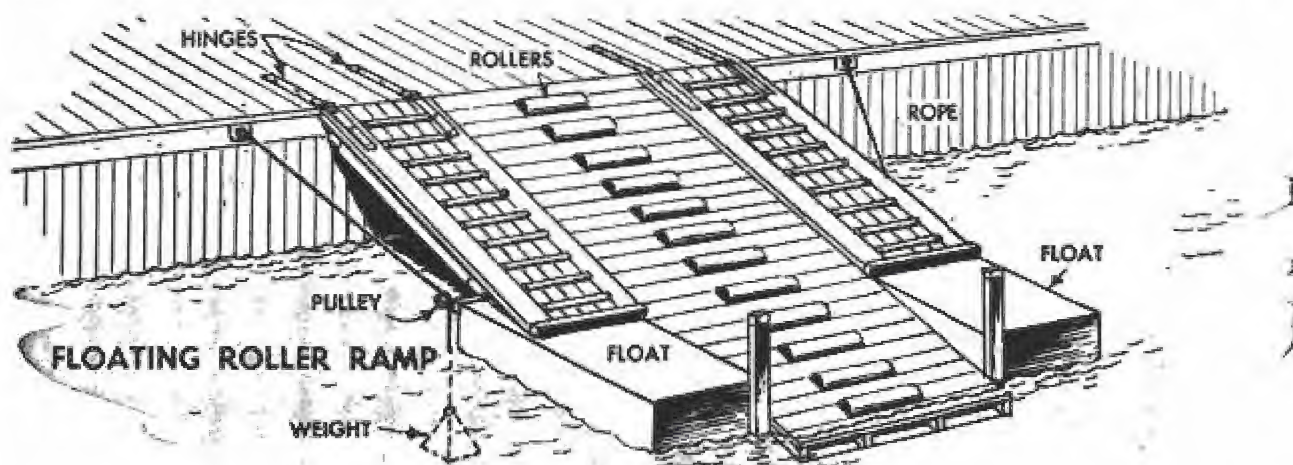
The Ten Thousand Lakes Family Boating Club of Minneapolis-St. Paul encountered a lack of enthusiasm on the part of city fathers when it proposed a ramp that would give access to the Mississippi River. But when the Civil Defense possibilities were pointed out, the club got its facility. Boats can now be launched opposite St. Paul's business district by means of a ramp that consists of a hard-surfaced roadway to the river's high-water mark, with steel mat extending down to the low-water level.

The Jacksonville (Fla.) Outboard Boating Club worked with marine dealers of the area to conduct a survey to back up a contention that the municipal government should improve launching facilities.

The survey showed that an estimated 19,000 persons made use of two existing municipal ramps, which had cost the city \$8250, while only 4780 persons used the city golf and tennis installations which represented a municipal investment of \$409,000. A study of the 14 major Jacksonville retail outlets for equipment for these three

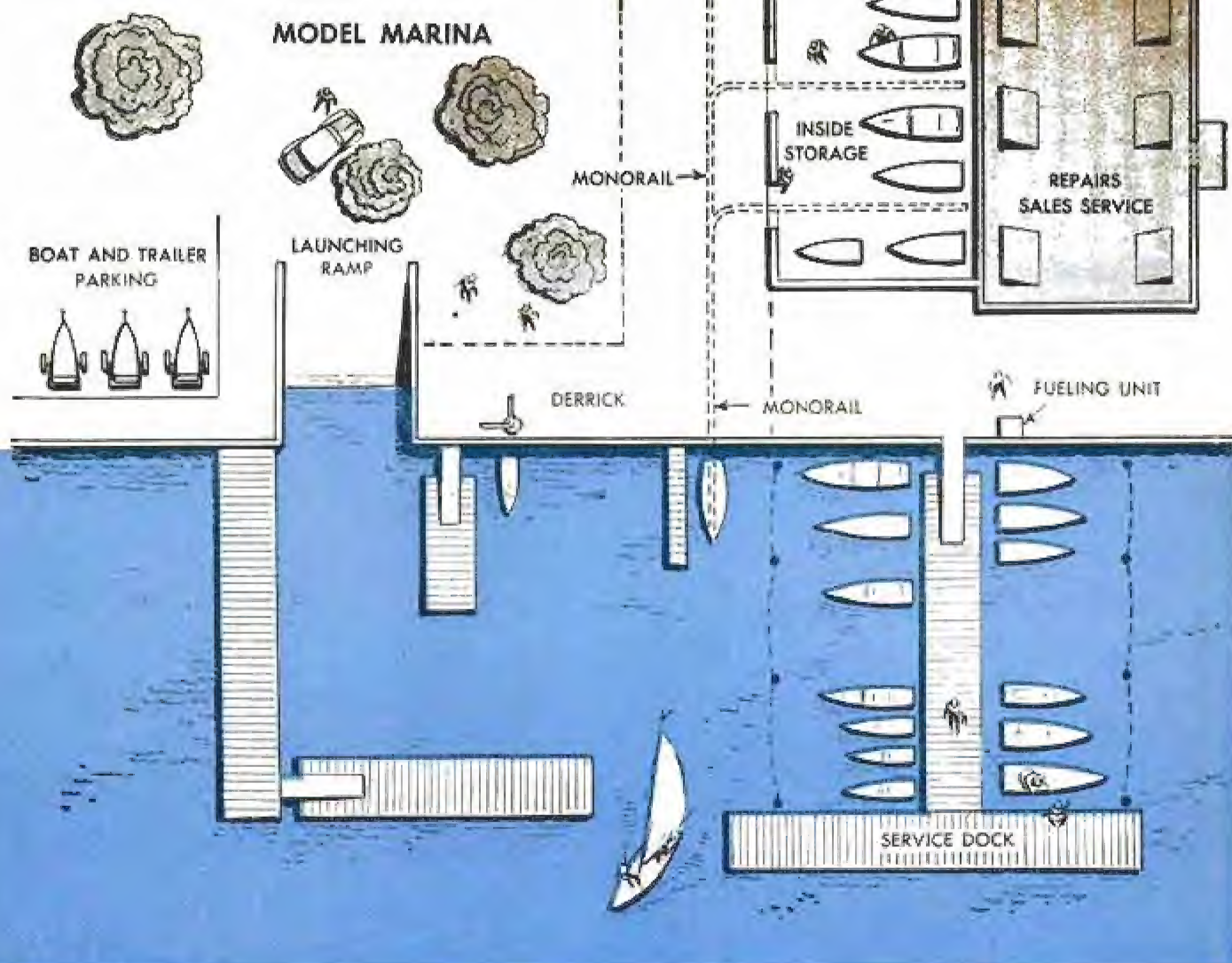


At a Wisconsin marina, boat is lifted in a sling and carried by monorail to the water or storage area



Drawing shows construction of a typical floating ramp. Below, rollers solve problem of moving a heavy boat





recreational sports showed a total of \$2,328,-860 spent for outboard boats, motors and supplies, while the golf and tennis-equipment total reached only \$117,000. Analyzing these figures, the city government saw that its investment in boat-launching facilities was only two percent of that invested in golf and tennis, yet the sales by local retailers of boating equipment was approximately 2000 percent of those made in golf and tennis stores.

Jacksonville's boating facilities are being improved.

Chicago's several outboard-boating clubs worked with city officials in designing ramps at three Park District harbors which give access to Lake Michigan. A new parking lot for trailers and automobiles will be ready for use during the 1956 season.

Commercial Mariners

Chicago's Temulac Boat Club is working with a member family to set up what will become a commercial establishment for boats and boaters. The family is developing a five-acre tract on the Little Calumet River into a facility that will provide such services as mooring, launching, fuel and provisions and a clubhouse. While it will be a commercial venture, club members will have use of the facility by virtue of dues paid to their club treasury.

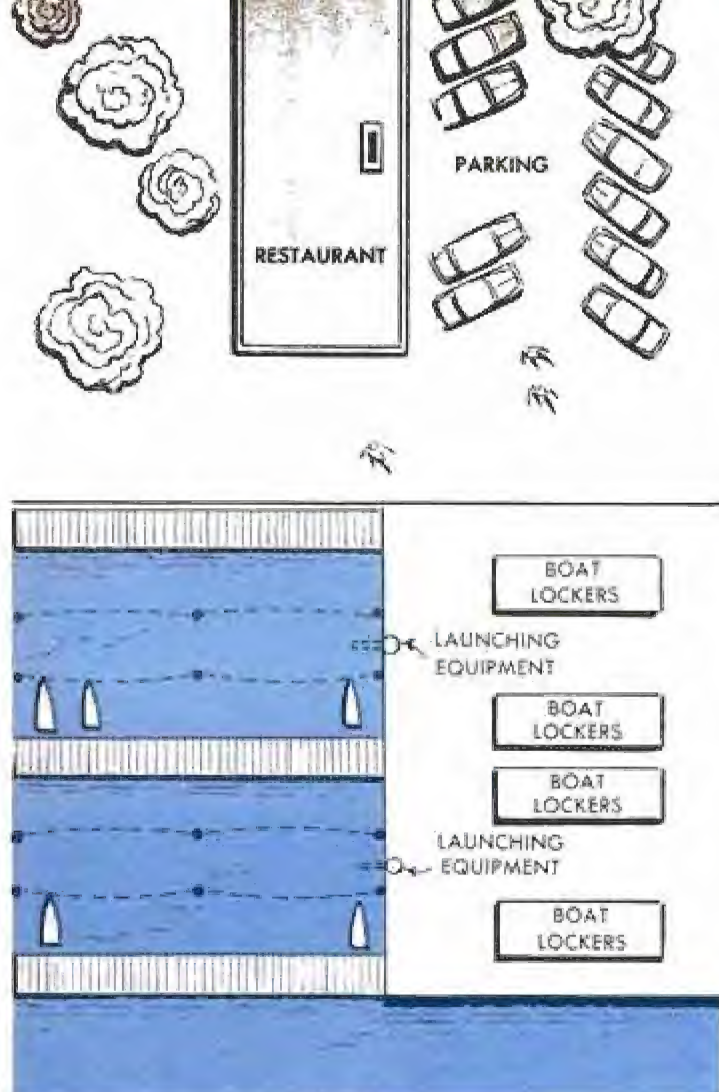
In Florida, the Leesburg Boat Club leased land on Lake Griffin from the city and then raised money to build two clubhouses, docks and other facilities.

Most of these new yacht clubs, outboard variety, have been organized in the last 10 years. Just how many of them there are is anybody's guess.

The Outboard Boating Club of America (which calls itself OBC for short) fills thousands of requests annually for a free booklet on how to form a club. The booklet is complete with instructions for getting

Homemade dock is the simplest of facilities to build





Drawing shows facilities of a typical marina. Right, overhead monorail lifts out boat, places it on a dolly

started, sample bylaws—and even sample membership-building letters and releases for the press.

The clubs have much in common with the yacht clubs of the traditional type. They create boating facilities for the use of club members. They hold social functions. Members go cruising, stage regattas and turn out with pennants flying for special occasions.

The outboard version of the yacht club of old is different, however, in one regard.

Outboard clubs cut across all occupation and economic lines in their memberships. The commodore of one Chicago club is an executive of a metal-fabricating firm; other officers include a truck driver, a school principal and a politician. A Wisconsin club, headed by a barbershop proprietor, has a school athletic coach for its vice-commodore; its members include bankers, manufacturers and business executives.

All clubs are organized primarily to have

(Continued to page 240)

Small-boat owners have a big choice of strong prefabricated docks which arrive at the site in kit form



Detroit Listening Post



By Leo Donovan

IF YOU'RE PLANNING a garage for your '57 car, better build it a couple of feet longer, just to be safe. Insiders (who claim they know) say the lengthened frames for next year's Ford indicate a lower car, several inches longer.

Henry Ford II, president of the Ford Motor Company, disclosed during testimony in Washington some weeks ago that push-button shifting may appear on some of his 1957 cars.

Although safety-belt sales admittedly have been disappointing, particularly in the big-city markets, Ford's second annual national safety forum is expected to introduce more safety features this summer.

General Motors has said that its 1957 cars will be introduced at about the same time as last year—in October or November. Ed Ragsdale, new general manager at Buick, stated that the 1957 Buicks will come out in November. It is definite that the 1957 Buick will be all-new, as will the Olds and Cadillac. And there will be more than sheet-metal changes at Buick. The chassis will be different. However, it is doubtful if Buick or anybody else will have the much-talked-about "air ride" for 1957. For 1958, maybe.

Whether Pontiac and Chevrolet will be all-new is still speculative. Both share the same body shell, so they do or don't together. But with Chevrolet sales up sharply (the only GM division that is, by the way), there is some talk that it would be dollar-foolish to get on a two-year-cycle treadmill when the three-year-cycle cars are still selling. Of course the unknown is whether a 1957 Chevrolet facelift could sell against an all-new Ford and Plymouth.

Contributing to Chevrolet's sales record is, no doubt, the increased availability of its V8 engine which was in short supply last year, especially during the early months. In the battle for first place, Chevrolet seems to have proved that power outsells safety. Chevie has been stressing its record-setting performance as "the hot one." Ford's original advertising this year

stressed safety, playing down performance.

What happened? Chevrolet moved far in front of Ford in sales during the early part of 1956. In the same period last year, Ford was ahead of Chevrolet.

Then Ford switched its pitch and introduced a new model with additional power. With it, Ford is winning races and telling the nation about it. What this will result in is anybody's guess.

Chevrolet's big lead provokes speculation that Ford may introduce its 1957 models earlier than planned (September seems likely) and with greater changes.

More Rainbows?

Aluminum is continuing to replace certain steel and chrome-plated zinc parts. The Electric Auto-Lite Co., announces new facilities for stamping aluminum grilles and trim as well as new anodizing equipment for coloring the metal. This is expected to mean that some, if not all, Chrysler Corporation cars will feature colored aluminum brightwork in '57.

Ford has announced a contract with Reynolds Aluminum that may indicate an even greater use of aluminum than just trim parts. It may be that we'll see aluminum radiators.

Ed Cole, chief engineer for Chevrolet, forecasts the beginning of a light-metal era in car design which will result in as much as 100 pounds of aluminum per car by 1970.

Kaiser Aluminum is reported developing a one-piece wheel, drum and hub made of die-cast aluminum.

Solid, Not Spectacular

The new car that Ford plans to bring out for 1958 (which will not be called the Edsel, although no other name seems to be bandied about) will not be revolutionary. It will be a good, solid performer in all speed ranges. Don't expect any engineering spectaculars like four-wheel independent suspension or fuel injection or turbine power! It will embody good, sound engineering concepts and will be in no way experimental. To make any economic sense at all, it will probably share the Lincoln body shell so you can guess at its dimensions. As you know by now, it will fit between Lincoln and Mercury in price.

What are engineers at Continental Division doing these days? Although the division is aloof to annual style changes, they are working on the Mark III. However, its introduction date is still in the dim distance. When the change does come, the current two-door model will be replaced by a four-door hardtop. This will require some readjustment of proportions. For one thing, the hood will have to be shortened to make room for more "greenhouse."



Inflatable Airplane

Like blowing up your water wings before swimming, you can now inflate your airplane before flying. At least, that's what the Goodyear Aircraft Corporation had in mind when they developed this inflatable rubber plane that can be deflated and packed into the trunk of the family car. Wing, tail assemblies and pilot's seat are made of Airmat material, a rubber-coated nylon fabric. Less air pressure than that required to inflate passenger-car tires is needed to pump up the plane. It is powered by a two-cycle, 40-horsepower motor mounted on a tubular support above the fuselage and behind the wing.

Only metal on rubber plane is motor support and wheel assembly. Below, deflated and folded, plane makes compact package



They Build Fords in England, Too, and Here Are the New Models

Big enough to seat six, British Fords come in three models. The two top lines, Zodiac and Zephyr, have a 107-inch wheelbase and are 178 inches long over all. Their six-cylinder engines develop 86 horsepower.

The smaller Consul (right in photo below) has a 59-horsepower four-cylinder engine. All are built with unit or integral body construction. The engines feature Ford's German Taunus hollow crankshaft.



The New French Revolution—in the Air

Text and Paintings by G. H. Davis

EARLY AVIATION HISTORY is filled with the names of French aeronautical designers and builders—Voisin, the Farman brothers, Bleriot, Breguet, Nieuport and many others. From the first investigations of powered flight up through World War I, French planes were among the world leaders.

But between the two world wars, the United States, Great Britain and Germany raced ahead in aircraft development, while in France the industry seemed overcome with lethargy. At the air shows there were always ultramodern models displayed by French engineers—but these seldom got out of the model stage. France had an advanced air fleet on the drawing boards and, unfortunately, an obsolete one in the air.

This was the condition at the outbreak of World War II, when German Stuka dive bombers roared

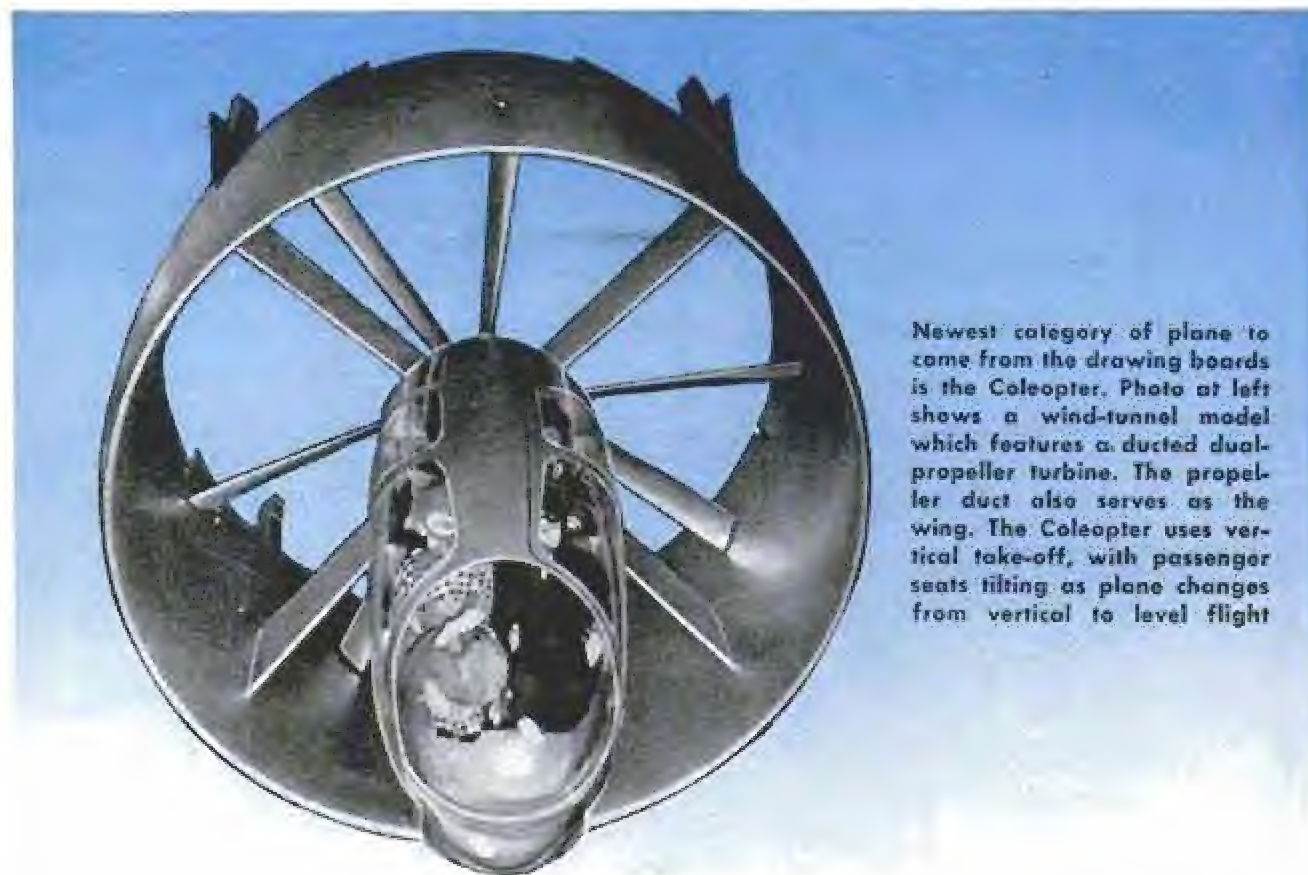
through the sky. The French had nothing that could cope with them, even though the Stuka later proved to be vulnerable when opposed by the modern fighters of the United States and Great Britain.

Following World War II, French aeronautical designers continued to produce plans for aircraft of an advanced and even revolutionary nature. But few were built.

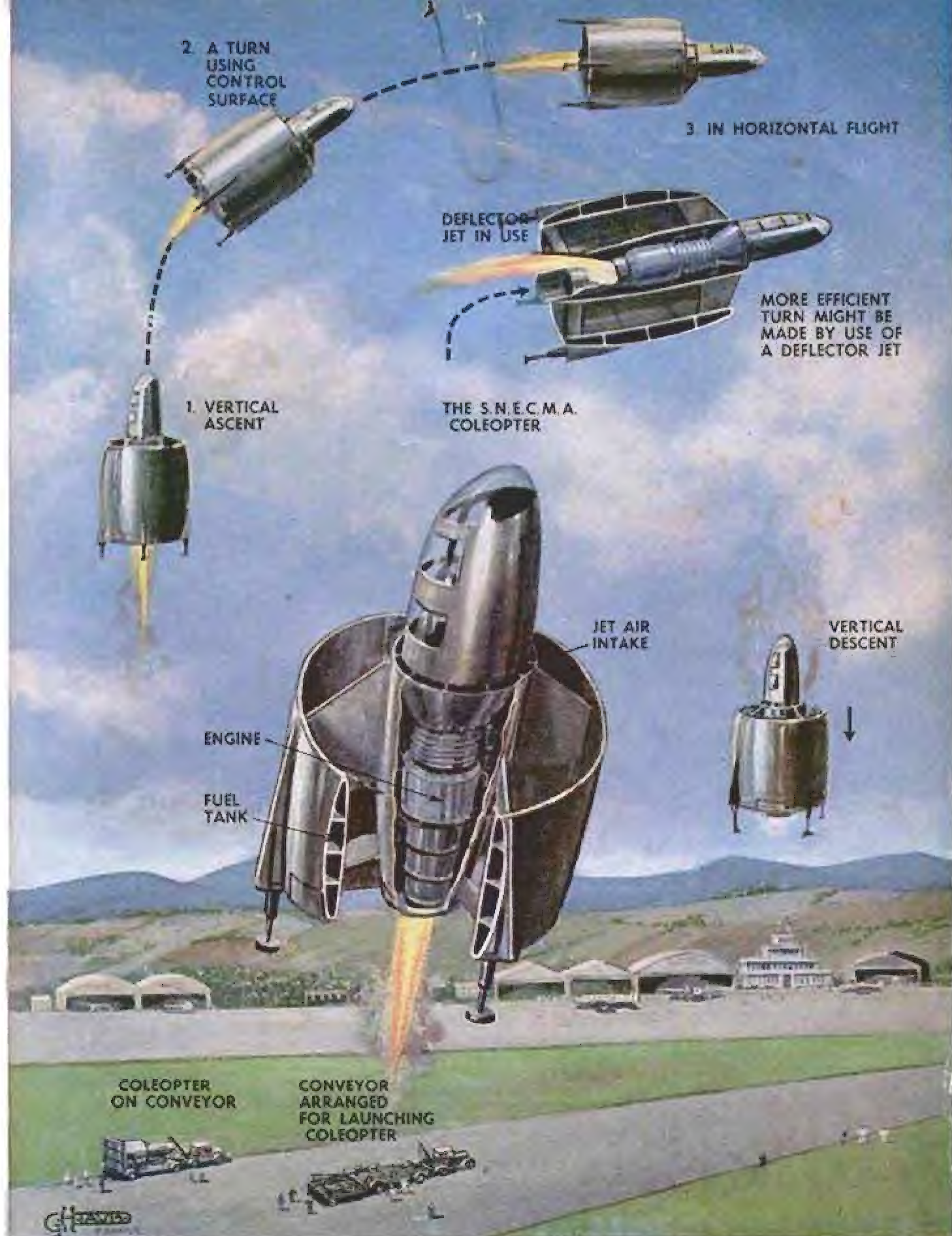
In the last few years, however, there have been unmistakable signs of a change in France—perhaps the ground swell of an aeronautical revolution. French inventiveness and ingenuity have continued at a high level, and more and more new French types are getting beyond the blueprint and model stages, as prototypes are built and experimentally flown.

On these pages we show a few of the excellent designs that have been flown in France recently. ★★

Mr. Davis, internationally known British artist, journeyed to France to make these on-the-spot paintings for *Popular Mechanics Magazine*



Newest category of plane to come from the drawing boards is the Coleopter. Photo at left shows a wind-tunnel model which features a ducted dual-propeller turbine. The propeller duct also serves as the wing. The Coleopter uses vertical take-off, with passenger seats tilting as plane changes from vertical to level flight



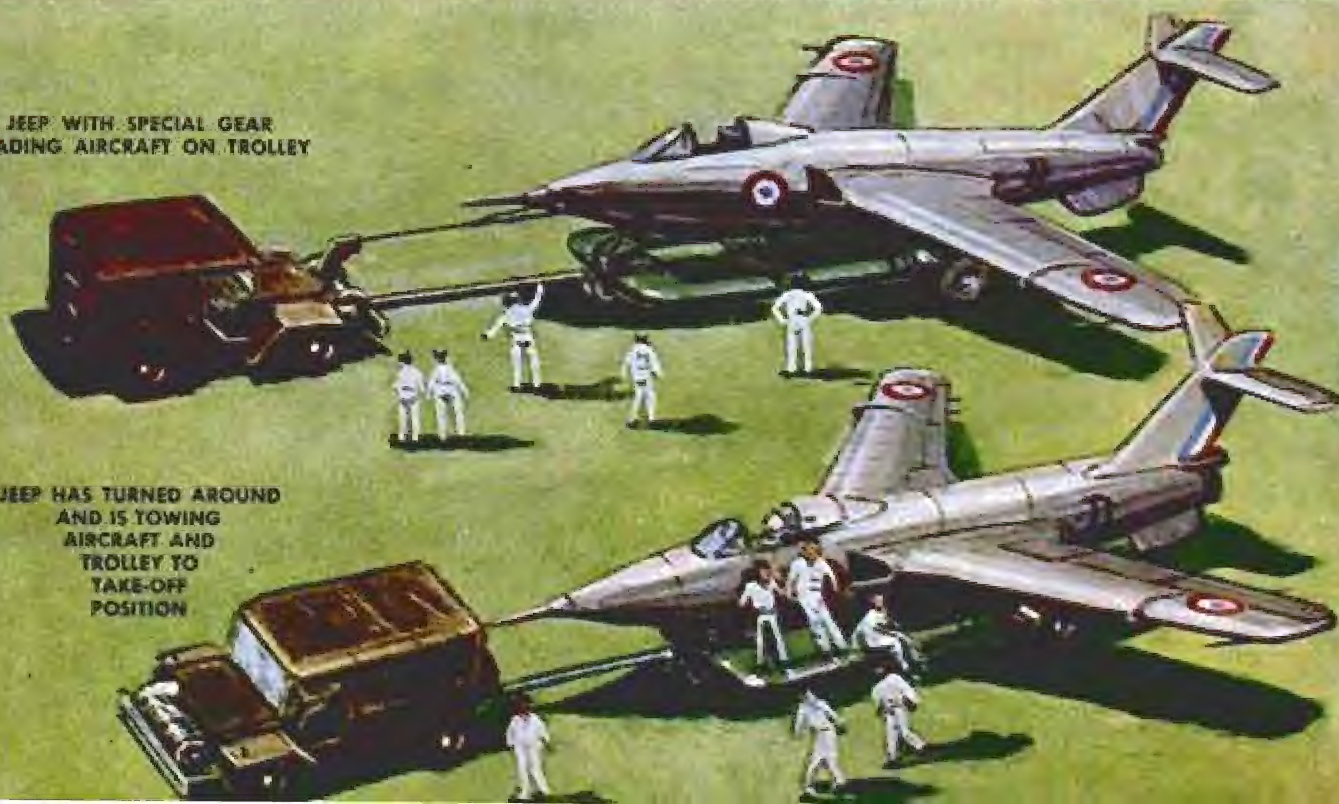
Military version of the Coleopter, shown above, is powered by an Atar 101-E jet engine. Wind-tunnel studies indicate that it would climb to 49,200 feet in two minutes, and have a speed exceeding Mach 2 in level flight. Designed and patented by Helmut von Zborowski, builder of the plant that produced the first rocket aircraft, the Messerschmitt 163, the Coleopter is being tested and refined by S.N.

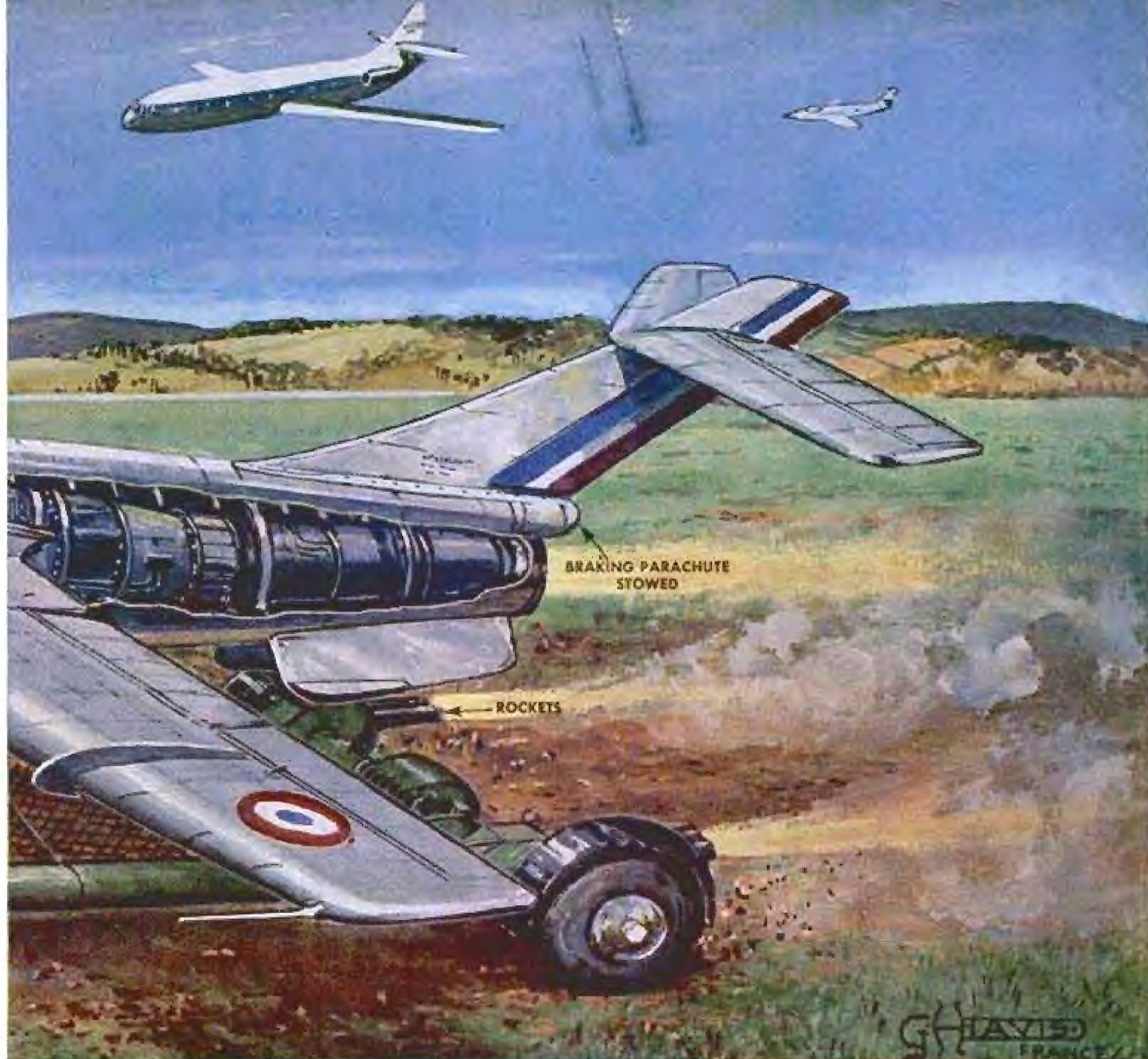
E.C.M.A., French manufacturer of aircraft engines. The annular wing, which serves simultaneously as a lifting surface and a power-plant housing, is light in weight and easy to produce. Since the Coleopter is launched from a special truck-trailer, it requires no airport as a base of operations. One objection to the design: In the event that the engine failed, the crew would have no choice but to bail out



JEEP WITH SPECIAL GEAR
LOADING AIRCRAFT ON TROLLEY

JEEP HAS TURNED AROUND
AND IS TOWING
AIRCRAFT AND
TROLLEY TO
TAKE-OFF
POSITION





AIRCRAFT LANDING ON ITS SKIDS
WITH BRAKING PARACHUTE IN USE

France has done a considerable amount of experimental work with aircraft suitable for NATO requirements, one of which is that the plane should be able to take off and land on unprepared grass fields. One of the most interesting types evolved is the Baroudeur SE-3000, a light fighter that is launched from a trolley and lands on skids. The trolley is provided with four rockets to give it sufficient speed to launch the plane. At take-off speed, the pilot cuts the trolley loose and climbs. The trolley is braked automatically. Tests have shown that the Baroudeur will fly with the trolley still attached. The take-off run is less than 770 yards. The transport above the Baroudeur in the picture is the new Caravelle, designed for 70 passengers. Powered by two Rolls-Royce Avon turbojet engines, it has a range of 1500 miles



Leduc-021 is carried aloft on top of a Languedoc airliner, and when its ramjet engine starts building up power it is released. It has a ceiling of 65,000 feet and an endurance of 15 to 25 minutes after release. The central body is used to form a diffuser, with a duct to give maximum ram increase. The combustion chamber is formed by a number of concentric rings, each of which carries a triple ring of

high-power injectors or burner-nozzles. A turbine in the assembly is used for an accessory drive and also provides the flame for ignition. The shroud narrows at the rear to give the burning gases added velocity as they escape. In the event of an emergency, the entire nose section is detached from the plane with the pilot still in place and three parachutes lower it to the ground. Designer is Dr. Rene Leduc

SPLIT RUDDER
ACTS AS
AIR BRAKE

NOTE SIZE OF
PILOT FOR COMPARISON

NOTE
CURVED
LEADING EDGE

THE VERY
SUCCESSFUL
"TAON"

EXPERIMENTAL
PAYEN P.A. 49
CLAIMED TO BE
THE SMALLEST
FIGHTER
IN THE WORLD

THE SECRET
"MYSTERE XXII-B"

AT LEAST TWO OF
THE LARGE AIRCRAFT
FIRMS HAVE UNDER
DEVELOPMENT VERY
FAST DELTA-WING
LIGHT FIGHTERS

DASSAULT SECRET
EXPERIMENTAL DELTA-
JET WITH A SPAN OF
UNDER 14 FEET

WITH TWIN JETS

THE "GERFAUT" 1402-B
CLAIMED TO BE THE FIRST
AIRCRAFT TO FLY SUPER-
SONICALLY IN LEVEL FLIGHT
WITH UNAUGMENTED POWER

TWO ROWS
OF VORTEX
GENERATORS

AFTERBURNER
ALSO FITTED IN
LATEST TYPES
STRAKE

ARRESTER
PARACHUTE
STOWED

GUN PORT

30-MM. GUN
AMMUNITION
PACK

AIR INTAKE
PASSING UNDER
COCKPIT FLOOR

DELTA WING
CONTAINING FUEL TANKS

ANHEDRAL
TAIL PLANES

FUEL TANK

CHEMICAL
ROCKET MOTOR
FOR FIGHTING-SPEED
BURSTS AND TAKE-OFF

MYSTERE
IV-B

WING TIP
"VIPER" TURBOJET

THE REVOLUTIONARY
"TRIDENT"

WING TIP
"VIPER"
TURBOJET
1648-POUND THRUST



An electric drill burrows into a mountainside made of uncooked rhyolite. Heat turns rock into a rainbow

They Cook the Rainbow Into Rock

By Leland Elam and Leo Rosenhouse

VOLCANIC ROCK from California's Sierra Nevada Mountains is being cooked like baked potatoes to produce a rainbow-colored material that is proving a boon to the building industry.

The material is rhyolite and it is distributed commercially under the name of Placerite. Rhyolite, which until recently has been scarce, is well-known to geologists. This material is a light-colored rock, similar to granite except for a fine-grained texture. It can be worked much in the same fashion as hardwood. The rock can be cut, sawed, chopped, grooved, and it rarely cracks or crumbles as it ages. In pebble form it serves as roofing material or insulation. When used in the form of slabs or bricks, this rock becomes building blocks, patio stones, facings on houses and buildings, barbecues, walks, ornaments, curio pieces and is of practically unlimited

use. It's even used for costume jewelry.

This versatile product is composed chiefly of silicas and metallic oxides. It is the latter ingredient which carries the secret of the rainbow within the rock. Properly baked (2000 degrees F. for 14 hours) rhyolite turns into a flood of color with red, orange and bright yellow predominating. An entire mountainside of it has been found in the Mother Lode, not far from Old Hangtown (renamed Placerville). R. C. Young, an amateur geologist, discovered the rhyolite when he was looking for pumice. One of his tests was to bake it in a kiln with startling results. He found that bright sunshine, acid treatment, heavy sprays of water and natural erosion had no effect on the colors baked into the rock.

Rhyolite is obtained by surface mining which includes drilling, blasting and prying. Small segments are crushed for use as



Top, from left to right, a chunk of rhyolite moves into teeth of saw; slabs are fed into a "breaker" machine that looks like guillotine. Above, huge slabs are cut by a small-toothed saw into squares, strips and blocks. Above right, slabs are being placed in kiln for cooking. They cook 14 hours and cool 1½ days. The finished product is shown (right) used as a colorful building facing and flower box

roofing granules. A ton of it can be spread out to cover completely a roof area of 90 square feet.

Large chunks of the rock are cut by a water-cooled circular saw into slabs and small blocks. A 30-inch portion of rock can be sliced by a saw in less than two minutes. Cooking the rhyolite not only adds to its beauty, but increases its crushing strength from 4690 pounds per square inch to 7014 pounds.

Promoters of the rock believe that it will eventually come into use as kitchen tile and table tops. There's enough rhyolite for built-in rainbows for all. ★ ★ ★





Heavy landing craft is dropped on the beach by the LeTourneau retriever at completion of salvage operation

Giant Retriever for Landing Craft

LOOMING like a huge sea crab in the surf, a retriever to salvage disabled landing craft is now undergoing tests at Fort Eustis, Va. The retriever, built by R. G. LeTourneau, Inc., of Longview, Tex., waddles into the surf and straddles any sunken landing craft, up to and including the 67-ton LCM-8. Then it either floats the boat or carries it to the beach. The secret behind the retriever's mobility is an electric motor and gear-reduction unit built into the center of

each wheel, where it operates in a water-proof housing cooled by air pumped in under pressure. Each wheel is equipped with the world's largest tire, 10 feet high and 4 feet wide, for traction in soft terrain. Eight floodlights are spotted on the vehicle for night operations. The retriever was developed after a study showed that only 10 percent of landing-craft losses were from enemy action. The rest resulted from mishaps during beaching.

Self-propelled retriever is operated by one man. Crew assists by attaching hoist cables to disabled craft





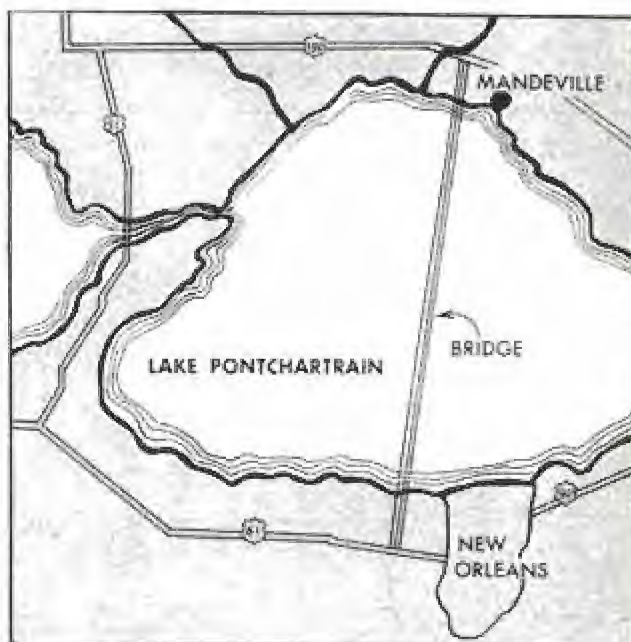
Cycling Soccer

Four soccer players, two to a team, mounted bicycles to play their favorite sport at Milan, Italy. The ball could only be "kicked" with a bike's wheels or hit with the hand to knock it into the opponent's goal. All of the men used special bicycles for the match

24-Mile Causeway Uses Prefabrication

Stretching across Lake Pontchartrain, La., to connect New Orleans and Mandeville, a 24.1-mile causeway is expected to be completed by December 1956. Contrary to most construction operations, all pilings, concrete caps and slabs of roadway are made in sections in a sprawling plant set up at Mandeville, and taken by barge out to the lake site to be put in place. The piles are driven into the lake bottom by huge pile drivers, and the road slabs, 56 feet long, are lifted by cranes to the top of the pilings. Some 750,000 tons of concrete will be used in the construction.

Prefabricated slabs of two-lane roadway, each 56 feet long, are placed on concrete pilings by crane



WHAT'S NEW FOR Your Home



1. UTILITY RACK that holds most of the implements used around the kitchen can be attached to the inside of a closet door. The rack is in three separate units, the top and bottom units being handy shelves. Dust mops, brooms and other long-handled tools are hung from hooks on the top shelf. The rack has a chromelike finish. Exposed ends are rubber tipped

Dennis Mitchell Ind., 4424 Paul St., Philadelphia, Pa.



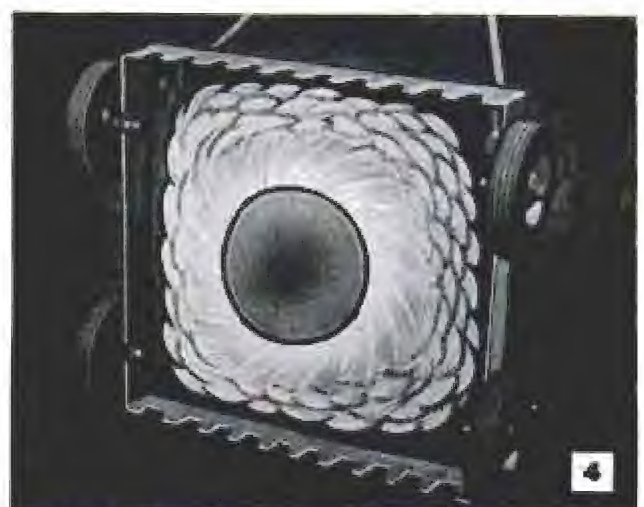
2. ROAST HOLDER of a novel design has four sharp prongs to keep roasts, turkeys, chickens, hams and other meats from slipping during the carving. When the carving is finished, a two-tined fork on the front is used to serve the meat. The double-purpose tool, called "Carv-n-Fork," is made of aluminum and plated with a chromium finish that is rustproof

Mrs. Dorothy Damar, 748 Damar Bldg., Newark 5, N.J.



3 and 4. SPRAYER ATTACHMENT will convert almost any rotary lawn mower into a lawn sprayer. The mower then can be used to spray insecticides, weed killers and liquid fertilizers. The attachment is a distributor disk which replaces the mower blade. A tank is mounted on top of the mower and feeds the liquid through an adjustable valve to the disk

Rocklin Mfg. Co., 110 S. Jennings St., Sioux City 2, Iowa





5. ANTISPLATTER COVER for use with electric or hand mixers will help the housewife keep her kitchen neat and clean. The cover is of stretchable plastic that slips over the edge of the mixing bowl, with a hole in the center for the mixing blades to enter

Frankl Plastic Products, 1200 Elizabeth St., Denver, Colo.



6. MILK DISPENSERS such as used in restaurants are now going to be available for homes. Dispenser keeps two 12-quart containers at 35-degree temperature. On delivery day, milkman replaces empty containers, eliminating the handling of bottles and cartons

Norris Dispensers, Inc., 2720 Lyndale Avenue S., Minneapolis, Minn.

7. AIR CONDITIONERS designed to fit into any casement window are attached to the window in the same manner as the screen. No window alterations are necessary to fit the conditioner in place. The entire unit is within the room, allowing window to be closed

Airtemp Div., Chrysler Corporation, 1600 Webster St., Dayton 1, Ohio



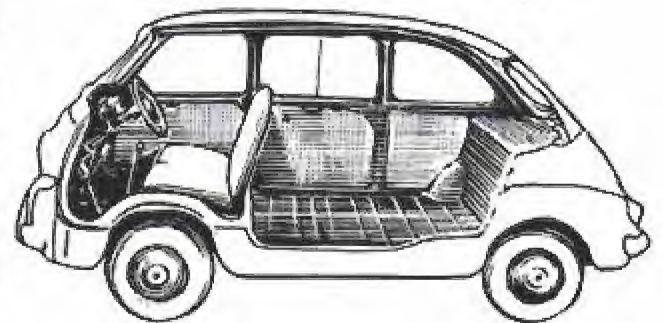
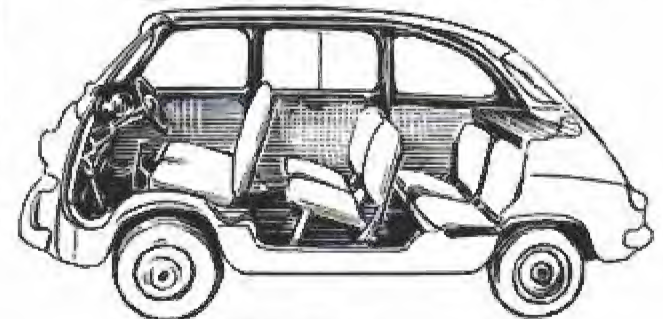
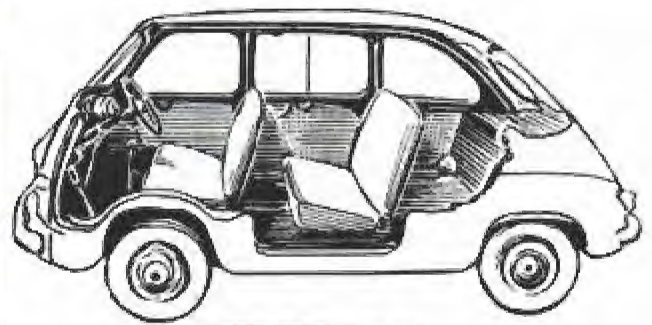
8. TRIPLE-THREAT KITCHEN appliance is a combination mixer, blender and electric knife sharpener. One compact 300-watt motor with six speeds drives all three. Fruit-juicer attachment is also available. Various combinations of the three units are offered

NuTone Inc., 200 Fifth Ave., New York City





Above, Italy's tiny station wagon is rear-engined. Right, top two sketches show two seat variations. Rear seats in both versions fold as in lower sketch



Italian Station Wagon

Called a utility car, the new Fiat Multiple 600 is a station-wagon version of the recently introduced Fiat 600, Italy's answer to the Volkswagen. It will seat six persons, although it is only 11½ feet long and 4 feet wide. The rear engine develops 22 horsepower. Its rear seats fold down into the floor, allowing the vehicle to be used as a small truck. Spare tire is carried vertically below the windshield.

Helicopter Serves to Lower Painter to Roof of Building



Lowering a painter from a helicopter proved necessary when a pumpkin-shaped radome at Thule, Greenland, was painted. The fabric-covered building, maintained by Bendix Aviation technicians, houses radar equipment. The painter and a rope ladder were lowered to the crown of the building. With the flexible ladder hanging from the center, the painter had no trouble in doing his job.

Natural-Gas Substitutes Made in Laboratory

Homeowners awaiting permission to install natural gas in their homes but thwarted by the lack of supply can take hope from the fact that research performed at the Institute of Gas Technology promises a laboratory-made natural-gas substitute. The biggest problem in achieving the substitute — the manufacture of a gas composed primarily of methane — has been solved on a laboratory basis. Commercial use will depend on tests now being conducted at the pilot-plant level.



Homemade unit at left photographs fluoroscopic X-ray image of chest. Commercial X-ray source is at right

Medics Build Own X-Ray To Fight Tuberculosis

Lacking a budget large enough to purchase chest X-ray equipment to examine Japanese civilians at Ashiya Air Force Base, Japan, two Air Force doctors built their own. To purchase the completed equipment would have cost almost \$3500, but by buying parts locally and assembling their own, the doctors built a unit for \$292. Used on 4339 patients, the machine has detected 62 active cases of tuberculosis. The cost per examination is 3½ cents, as compared with 40 cents on standard equipment.

After exposure the chest films are evaluated in this illuminated viewer. Cost is 3½ cents per examination



Snap-On Wall Panels Utilize Aluminum Channels

Perforated acoustic wall panels that fit onto aluminum channels can be installed on the walls and ceiling of a room in a few hours. Five different extruded channels form the basis for the snap-on, snap-off wall. Included in the extrusions are inside and outside corners, edging, furring and snap-on members. The channels are attached to the old walls or studs with nails, screws or adhesives. Sound-absorbing material is placed between panel and wall. The wall can be snapped off just as easily to be replaced, painted or cleaned.

❑ One electric motor built for the Armed Forces is smaller in diameter than a half dollar and shorter than a cigarette, yet contains $\frac{1}{10}$ of a mile of ultrafine copper wire.

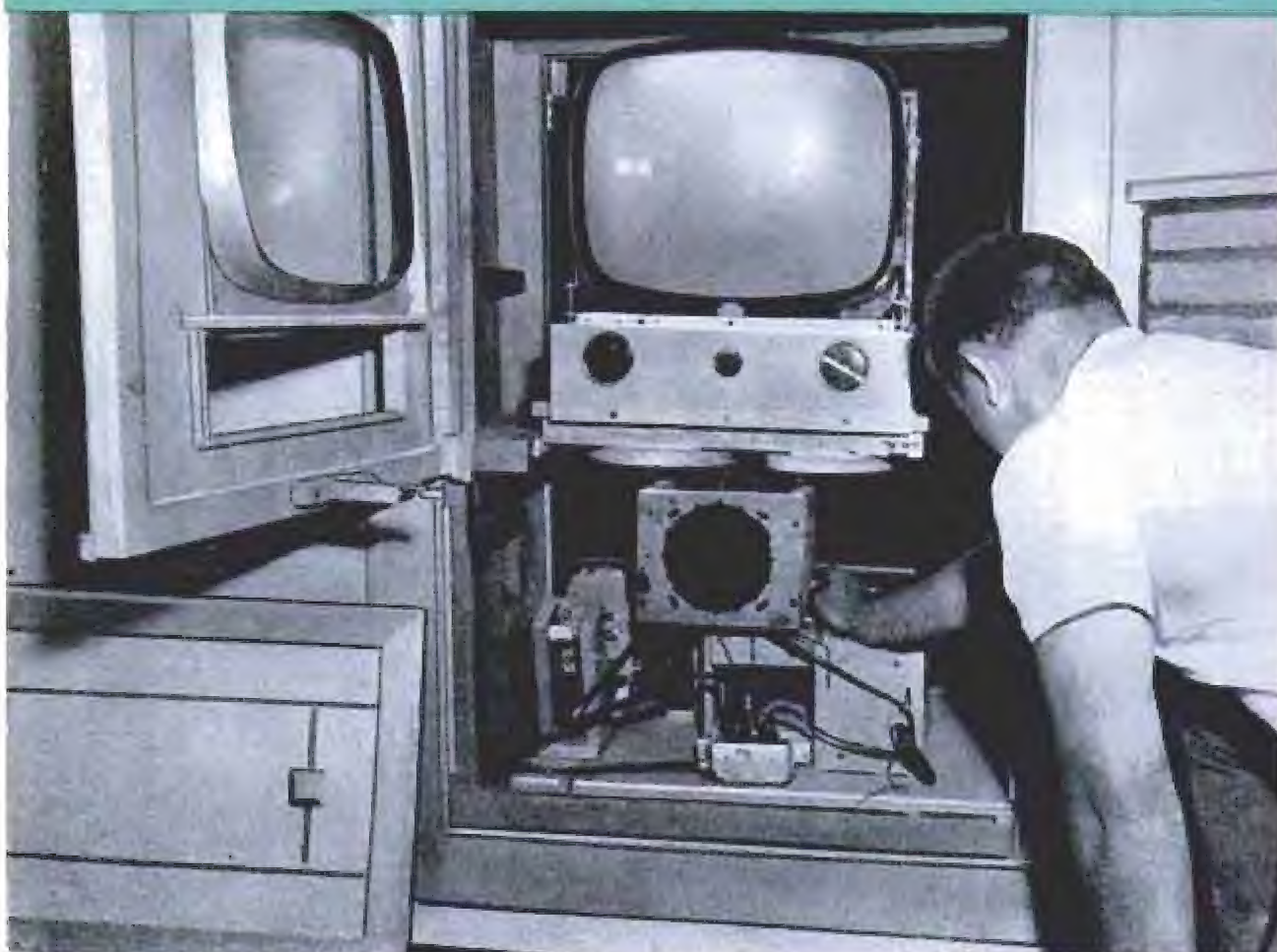


On the den side the TV set is flush with wall. Removable panel covers instrument-panel opening

*In a home full of homemade conveniences
a Phoenix electrical engineer has installed a*

TV That Looks Two Ways

Corbiener inspects speaker of television set. Electric motor drives pulleys to revolve the set





Here is the way set looks from the living-room side. Carbiener pulls out knob to start set revolving

By Henry F. Unger

WHEN AN ELECTRICAL ENGINEER turns his efforts toward improving his home, interesting results are inevitable.

That, in a nutshell, is the story of Homer Carbiener of Phoenix, Ariz., and his revolving TV set. It also explains the work-saving features built into his home, and even the decorations on the walls.

The two-way TV set cost about \$25 for materials. It enables viewers to watch from either the den or the living room.

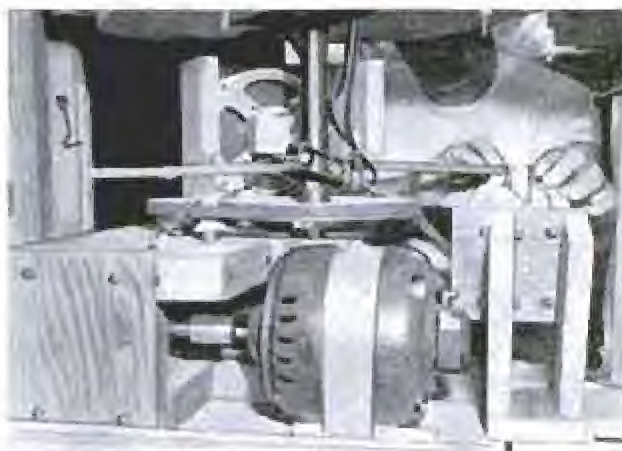
Housed inside a much larger cabinet, the TV set extends into the living room from a hole cut in the wall of the den. At the pull of a knob, an electric motor in the base of the cabinet goes to work and turns the set around so that it faces the den. A scenic view replaces the screen, and the knob opening is covered by a panel.

A cloth screen covers the speaker opening. Along the sides of the set are 20 slots for cooling purposes.

The set inside the cabinet rests on a turntable of $\frac{3}{4}$ -inch plywood. Beneath the turntable is a framework attached to a pipe standard which revolves. Nylon rollers support the sides of the set as it turns.

The motor shaft connects to a worm gear that has a 100-to-1 ratio. A V-belt drives two pulleys to give a half revolution in nine seconds.

In the kitchen, Carbiener has installed a roll-out shelf which keeps electrical appliances always ready for use. Around the Formica surface he has built a $1\frac{3}{4}$ -inch



Electric motor drives shaft that turns worm gear to revolve pulleys. Set, with speaker hanging from it, turns on pipe standard. Below, picture takes place of TV screen when it is turned to the other side





Appliances are always within easy reach when they are stored on roll-out shelf built into kitchen cabinet



Lazy Susan shelves in small kitchen cabinet turn to bring any needed pot or pan into convenient reach

Decorative fish and panel on wall were made by Carbiener of metal lath edged with coat-hanger wire



wooden piece for decorative purposes. On the outside and between the two doors, he has placed a false piece of $1\frac{1}{4}$ -inch wood to blend with the remainder of the setup.

Adjoining the roll-out shelf is a three-tiered revolving shelf housed in a cabinet. Four one-inch supports bolster the center and a half-inch pipe through the center fits into the pipe flanges. Eight nylon rollers beneath support the weight of the shelves as the unit turns to bring needed utensils into easy reach.

Carbiener has also built a novel primping mirror into the wall beside the front doorway. Recessed between the studs, it takes up no space and can't be knocked down.

Coat hangers furnish the material for many decorative and useful items around the Carbiener household. Holders for salt-and-pepper shakers, mail and earrings were fashioned by Carbiener out of hangers. On one wall is a school of fish with bodies made of wire-edged metal lath. Next to it is a decorative panel made of the same material. ★ ★ ★

Infrared Telescope

Speeding trucks are identified at night with an infrared instrument designed for Navy use. A spotlight bathes a section of the highway in invisible infrared light. A special telescope enables an observer to identify passing trucks while radarscopes check their speeds. The instrument is used by the Pennsylvania Motor Truck Association to police truck drivers.



Fokker F-27 flies at 280 miles per hour, but lands at 75. It can carry up to 28 passengers comfortably

Fokker "Friendship" Is Latest Short-Haul Turboliner

High wing of "Friendship" makes ground loading of plane easier, gives passengers better view and provides increased stability



Aircraft designers the world over are still working to find a modern replacement for that old workhorse, the DC-3. The newest entry into this race is the Fokker F-27, named the "Friendship," now being constructed in The Netherlands. The Friendship is a 28-passenger turboprop liner, powered by two Rolls-Royce Dart engines. The maximum cruising speed at its optimum flight altitude of 20,000 feet is 280 miles per hour. Revised versions of the plane could carry up to 36 passengers. The chief distinguishing feature is the high wing design.

Electric Log Stacker Lifts 20-Ton Load

In one massive "bite," a new electric log stacker lifts a 20-ton truckload of ironwood logs and deposits them on a pile. Ordinarily, the logs are dumped on the ground and then stacked one by one. The machine, which can take a 25-ton bite, inserts two 10-foot prongs underneath the load, then clamps two huge tusks over the top. After freeing the truck of the load, it turns and scoots off to a storage and processing area where the operation is repeated in reverse. The new stacker promises to save aching backs, time and money in lumber mills.





U.S. Fish and Wildlife Service photos

Salmon by the thousands show up in aerial photograph. Plastic grid laid over photo aids in accurate count

"SHOOTING" SALMON From

By Rafe Gibbs

THEY ARE COUNTING FISH in Alaska from the air—visually and photographically.

Even some old sourdoughs, who today are more used to airplanes than automobiles, are inclined to put this scientific development of the U.S. Fish and Wildlife Service in the "tall tale" class. Commented a stubble-faced, Irish prospector in the Bristol Bay area to a biologist:

"So you be countin' and snap-shootin' them fish—underwater, you say—from up

there in the sky? Interestin', interestin'. Reminds me of years ago in Dawson when some of the boys showed a bunch of goggle-eyed tourists a handful of ice worms. Ice worms? Oh, they're interestin', too. Spaghetti with ink dots for the eyes."

But the aerial fish counting—vital to checking on Alaska's multimillion-dollar salmon industry—is no tall tale of ice-worm altitude, unless you figure it starts about 600 feet up. It is not stretching this fish story, either, to say that an observer may



see in one day's flight as many as 300,000 salmon on their death trek to spawning waters. From the land, he would spend weeks trying to spot that many fish.

Alaska is big and rugged—586,400 square miles of mountains, brush and tundra. Consequently, in Alaska you use an airplane whenever and wherever you can. As the Nome postmaster, who had just begun using airplanes for remote mail deliveries, commented in 1928:

"The day of the dog is done."

But the first fish counting by air in 1930—prelude to today's improved and highly systemized methods—started by accident. Actually, because the fish counter arrived too late to do enough counting by land to make it worthwhile. The counter, C. M. Hatton, a resourceful employee of the U.S. Bureau of Fisheries, hired a bush pilot to fly him over the spawning beds.

Today's use of the airplane, however, is no expedient. The plane is being used because it provides a cheaper method of counting—a saving of about 90 percent—and a better method in certain areas, on broad streams, on lake beaches and in the mouths of streams. Accuracy of this method is astonishingly high.

"With surface methods in such places, you get only vague impressions of numbers," explained George J. Eicher, Jr., who is heading the aerial work out of the service's Seattle office. "You are bothered by reflections, the salmon are inclined to scoot off when they see you, and your angle of view doesn't let you look very far below the surface of the water. In a plane, you can overcome these problems—but an aerial-survey trip is no joy ride."

Added Charles Hunter, another member of the U.S. Fish and Wildlife Service:

"It's particularly not so good for the stomach."

He may have flown with the pilot who claimed that he "not only twists the plane at the bends in the stream, but joggles it up and down for the waterfalls."

The survey plane with pilot and observer moves over the stream or beach in visual counting at a constant speed and altitude—about 75 miles per hour and 600 feet up

Men of U.S. Fish and Wild Life Service interrupt flights to catch sample specimens in nets. This way they check on size and age of fish

the Sky





Salmon population in 1955 was one of largest since 1913, thanks to conservation program. This assures big catches like above for years to come



get the best results. The usual impulse of a new pilot is to fly too low. Result: The observer sees too many fish too fast, and gets all tangled up in his arithmetic.

If the fish are few and far between, the observer uses a hand tally. When the fish get thick, however—and they sometimes literally clog streams—he has to rely on mental notes.

Where the salmon run heavy, the observer first counts 10 individual fish, then he mentally connects 10 such groups into a block of 100 fish. After that he starts multiplying by 100, and often gets up to 10,000 in a hurry.

Meanwhile, the pilot is just as busy. He must not only maintain speed and altitude, and follow the water course, but must keep the plane in the correct relationship between sun angle and fish to avoid glare. Where there is glare,

Salmon in this unusual photograph taken over Kejik Lake, Alaska, seem to be moving in military formation—point, main body and rear guards

there are no fish—to be counted.

Then there are the distractions.

Flying along a river, the observer is intensely counting fish when he sees two huge brown bears beside the water. They are fighting over a fish, charging, slashing. Now one bear clamps teeth on the neck of the other . . . but the observer must turn his eyes again to the fish, relentlessly weaving upstream.

"But the main problem," said Eicher, "is fatigue of pilot and observer. As the men become weary and get in more of a sheep-counting than fish-counting mood their efficiency drops sharply. It has been found that by breaking up the period—landing and relaxing a bit—it is possible to extend a day's survey to six hours, not counting the return to base."

Those stopping periods can be diverting, especially when they come at native camps. The old bucks are usually interested in reports on how the salmon are running, for the fish have been a major source of food for many centuries. But the youngsters more often than not want to know if the biologists have any bubble gum.

Men of the Fish and Wildlife Service have chanced upon such native activities as a reindeer rodeo, complete with "bulldogging." When a young buck was asked where he learned the cowboy art, he replied:

"Movum pitchurs . . . Roy Rogers."

Taking photographs of salmon for later counting is more intricate than counting on the spot. The methods now used have been worked out by joint pioneering of Eicher and George B. Kelez of the Fish and Wildlife Service.

The plane flies at about 75 miles per hour at altitudes varying from 500 to 1000 feet, depending on stream width. And that stream must be followed just as closely as in visual counting, if not closer. Planes used have been various—usually whatever was available.

The camera is an F-56, military-type aerial outfit with an 8½-inch lens, set in the bottom of the plane. The high light demand of underwater photography is alleviated by using fast panchromatic film with an index speed of 200 increased to 1000 through use of a special developer.

"Infrared film was recommended to us on the theory that it would produce white-appearing fish in dark water," said Eicher. "We tried it, and what we got was jet-black water with nothing visible below the



Seals are among forms of wildlife seen from the air by the flying biologists. These are gathering on the Bering Sea coast

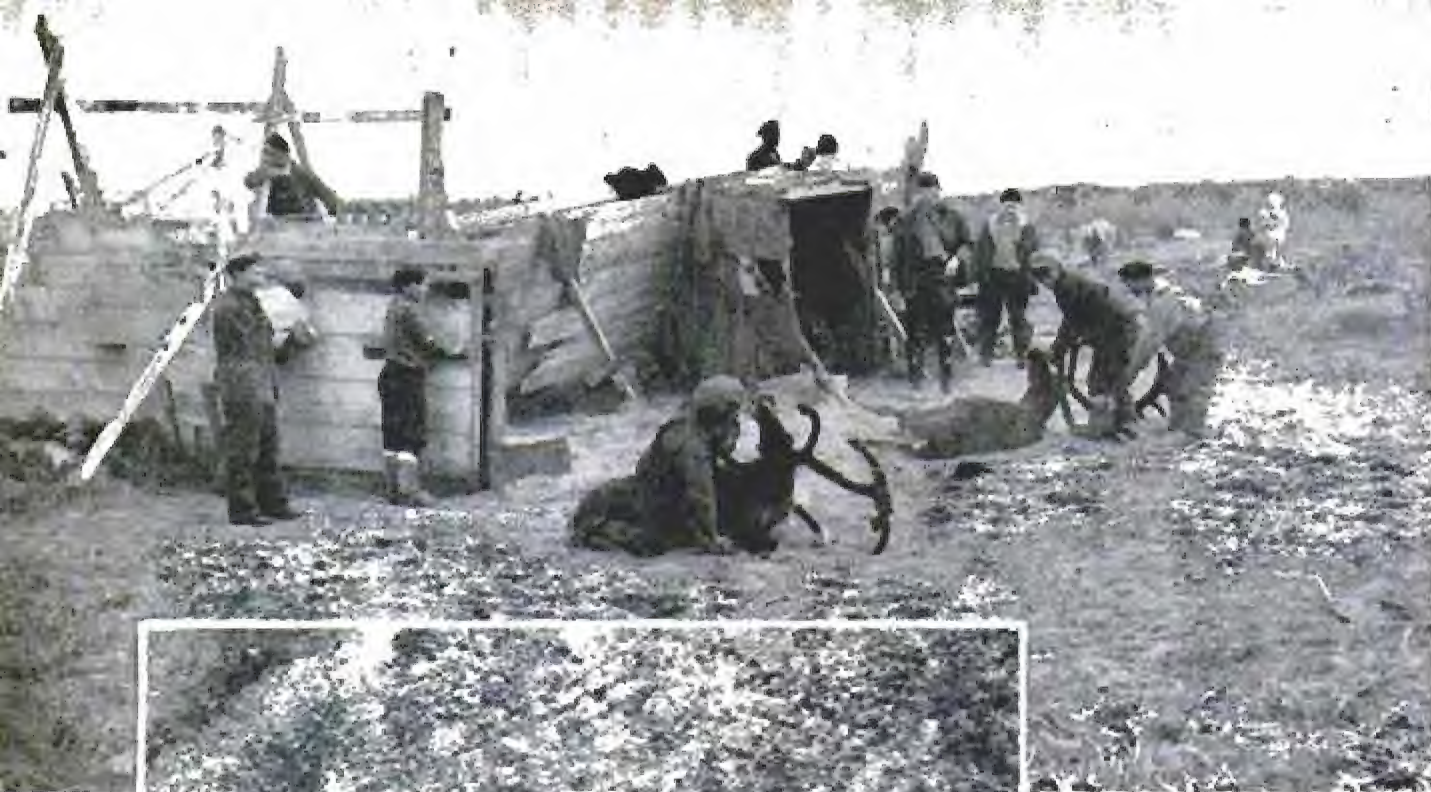
surface. Might just as well have been photographing a black bear eating blackberries in a cave."

Then there was the matter of filters. It was found that no single filter could be used for all situations. Now, for gravel and sand bottoms, a yellow filter is attached. On bottoms covered with vegetation or algae, a green filter is substituted. Then, in really deep water—to reduce reflections—it was found necessary to use a Polaroid filter.

Results have been some highly spectacular—and practical—photographs, which have played their part in conservation practices that have brought the salmon runs back as of old. In 1951, the runs were the largest since 1913. Runs in 1955 came close to this high.

In interpreting the pictures, a sheet of clear plastic, gridded into squares is laid over a photograph and the fish are counted.

"We haven't the time or money, of course, to photograph every mile of a stream," said Eicher, "but we are able to make a lot of spot checks. And the aerial photographs provide a permanent index. Photographs taken during different periods and different years give a good idea of changes in the fish runs."



Visiting biologists see a free reindeer rodeo as Eskimos, who learned lesson from Western movies, show "reindeer dogging"



Reindeer get their pictures snapped from the air, too. This stampeding herd was photographed near Nunivak, Alaska

Eicher spends most of his time in the Seattle headquarters and laboratories of the Fish and Wildlife Service but, when the salmon start spawning in Alaska, he heads north fast. The season is short—about May 15 to September 1—and the days are long, with the sun taking an unreasonable time to set. Both eight-hour day and five-day week are forgotten during spawning.

A pilot himself, Eicher loves the aerial work, even when he has to paddle his plane home. He did that once when his craft "conked out" on a take-off over Nystrom Lake. Bringing it down on the lake, he paddled to the shore, made the necessary repairs to the plane and promptly started skyward once again for another day of fish-surveying. ★ ★ ★

Life of Flashlight Dry Cells Quadrupled by Recharging



Increasing their life by 400 percent, dry cells used in flashlights are now being recharged at Northrop Aircraft, Inc. A compact bench-size charger holding 184 batteries at one time recharges the cells in two hours. Efficiency of the cells is as good as when new up to the third recharging, and four charges are the limit of the cell's usefulness. Before installing the charger, Northrop used and discarded 13,000 dry cells per month.

Pasture in the Barn Produces Winter Feed

Farmers can grow green grass for their cattle during the winter with a "pasture" housed in the barn. In six days, seeds placed in a tier of trays produce succulent shoots seven to nine inches high. When the grass-filled trays are placed before them, the cattle eat even the roots, for no soil is used in the growing process. The plants are nourished by enriched water that flows through the perforated bottoms of the trays. Minerals necessary to the growing process are mixed with the water in a tank on the top of the electrically heated, glass-enclosed structure. Automatic regulators feed the water to the plants in controlled amounts. The system, brought to America by Karl and Petti Wagner, now of Dallas, Tex., is designed for feeding swine, horses, sheep and poultry, as well as cattle. The green forage in mid-



Easily removed trays with plants in various stages of growth are contained in the well-heated, glass-enclosed "incubator"

Plants are ready for harvesting six days after seeds are placed in trays. Water enters tray through bottom

winter promotes the health and productivity of livestock and results in important savings of other feeds. Dairy cattle are said to produce 10 to 20 percent more milk with 10 to 20 percent more butterfat when they get their winter greens.

Cattle eat roots and all of the juicy forage. No dirt is used in process. Enriched water feeds plants



Check Writer for Personal Use Can Be Carried in Pocket

You can carry a new check writer in your pocket. The seven by three-inch device prevents a check from being altered, for the numbers it prints are permanently embedded in the paper fibers. By pressing its keys, you can imprint the dollar sign, digits and a star. Openings beside each key enable you to align and space figures.

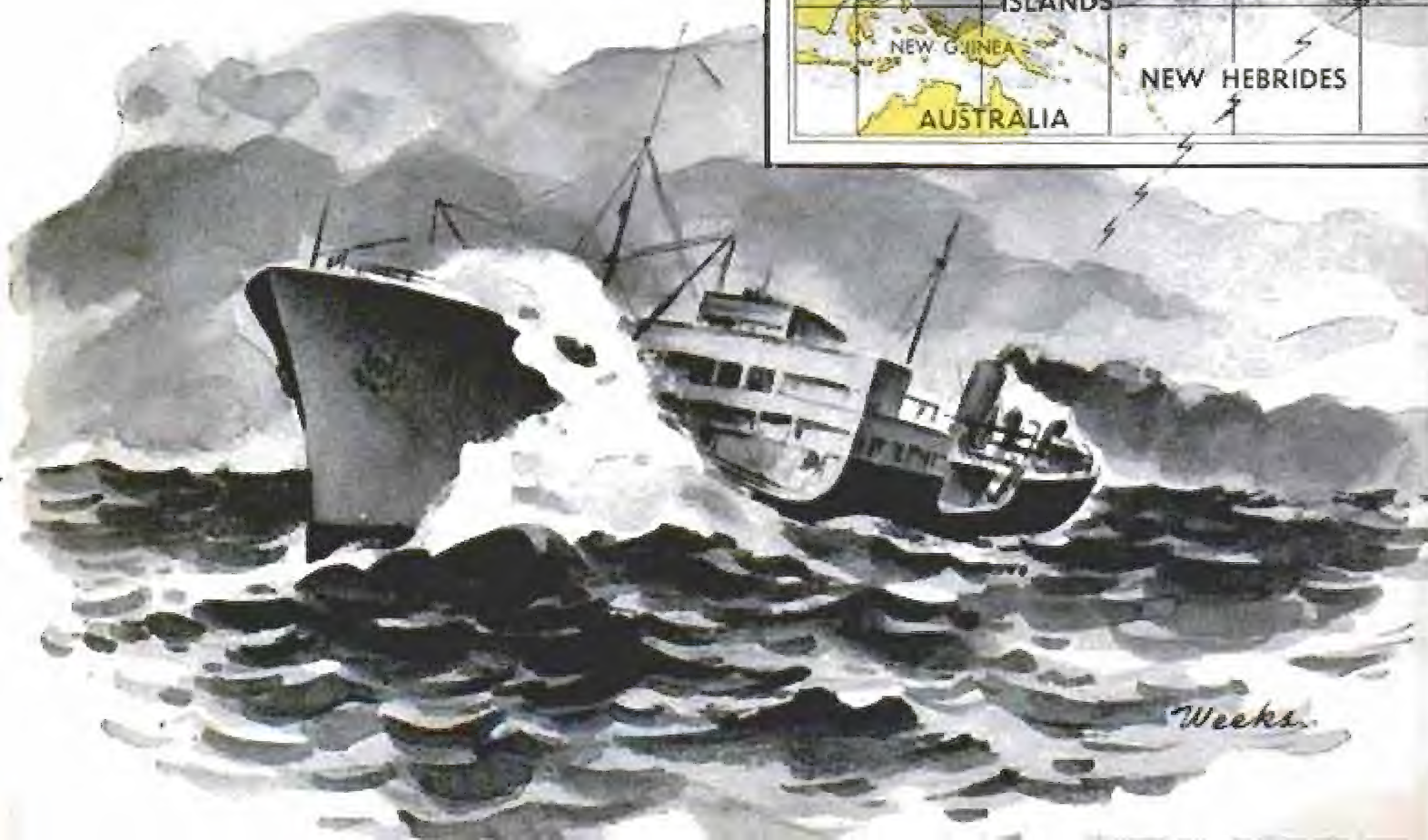
One digit at a time is printed by pressing keys. Check can be seen through open slots



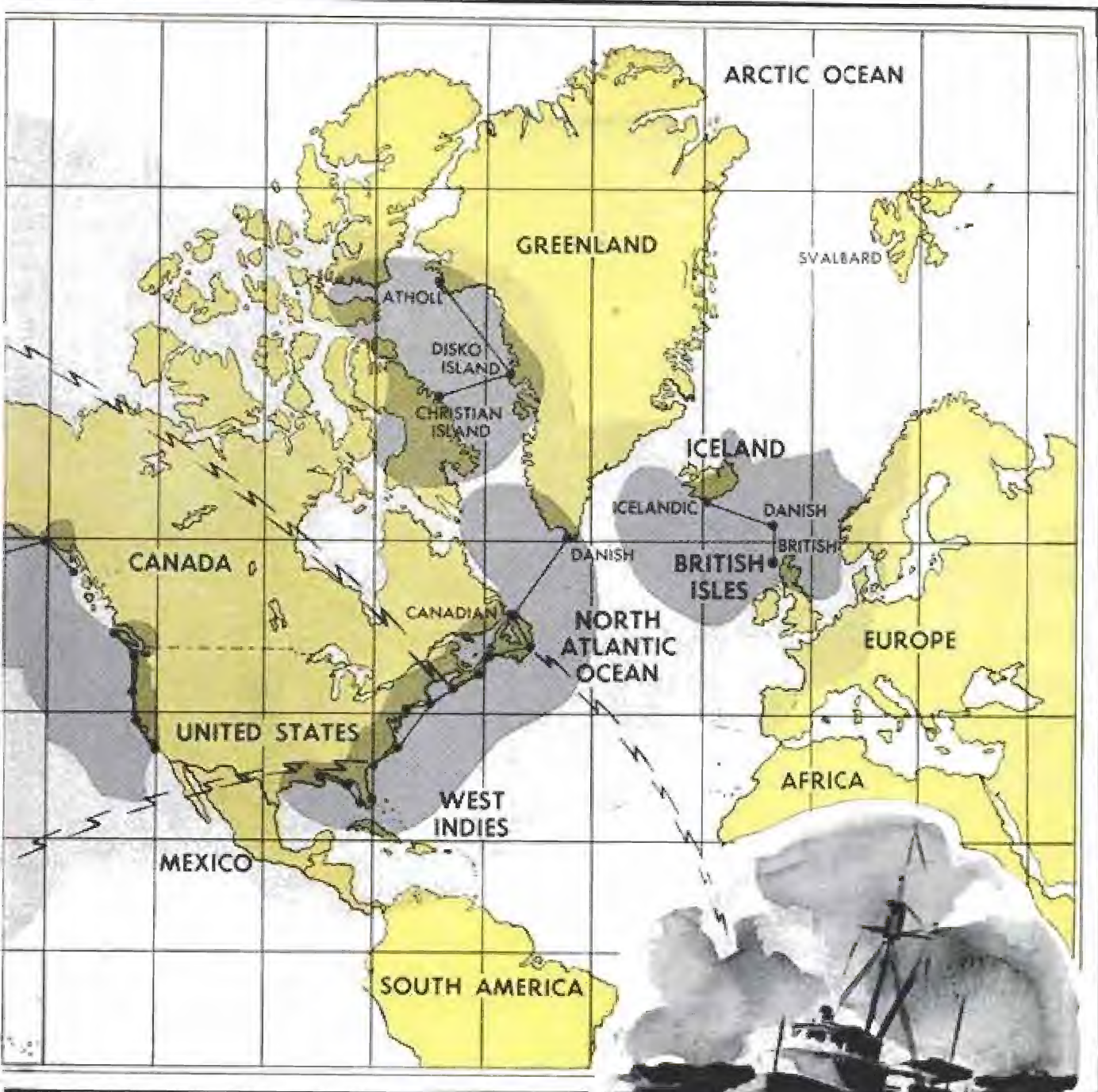


Eyes Over the Ocean

By Elliott H. McCleary



Weeks



Map shows location of all 54 loran stations in world. All are above equator and all but 11 are operated by America. Gray areas show day and night coverage

SOMEWHERE on the North Atlantic a fishing boat is lost under lowering skies . . . a tanker, heavy-laden with Texas oil, is threading the Gulf Stream northward . . . a passenger plane drones through the clouds toward Paris.

A score of years ago they would have been adventurers alone, navigating as navigators of the seas have done for hundreds of years. Today they have "eyes" in common—the eyes of the war-born miracle, loran.

Coastguardsmen keeping vigil at some of the loneliest spots on the earth perpetually watch and tune their instruments so that fishing boat, freighter, destroyer and the

continuous stream of air traffic over the oceans can always pinpoint their positions, regardless of weather.

Loran, the LONG-RANGE navigation system, was born of the wartime need for a sure method of guiding fighting ships and planes to port and to meetings on the high seas. Today it has settled down to the routine business of guiding peacetime air and ocean traffic; any traveler who cares to buy a loran receiving set can avail himself of the international loran services, and hundreds of ships and planes are using it every day.



Queen Mary officer operates shipboard loran set. Time difference in arrival of two signals is shown on scope and indicated numerically on dial at lower left. Below, skipper uses set's remote-control dial



Thus far loran guards only the North Atlantic and the Pacific; there are 54 stations at work, none in the South Atlantic. Most of them are operated by United States coastguardsmen. Canada operates six stations, Denmark three, Great Britain and Iceland one each. From such desolate spots as Pusan, Korea; Cape Sarichef, Alaska; Cape Atholl in arctic Greenland and from Tarumpitao Point in the Philippines, near the jungle home of fierce Moro tribesmen, American Coast Guard operators on round-the-clock watches keep the loran signals on the beam.

A typical station, located on a high cliff, a tiny island or a point of land jutting into the ocean, consists of a few buildings grouped around a pair of tall antenna poles. In one of the buildings, technicians watch scopes to see that the equipment is operating properly. Another building houses generators to supply electric power to the transmitter.

Loran stations operate in pairs; both are manned by small crews of scope watchers, but one station is called the master station and the other the slave station. They are 200 to 300 miles apart. The master station repeatedly sends out a time beat. After a measured interval of millionths of a second, the slave station sends out another beat.

The loran operator on ship or plane tunes in a pair of stations, which register on his picture tube as two "blips" of light. The distance between the two blips represents the difference in arrival time of the two signals.

By reading this time interval on the loran set, and using a special loran map, the



operator can tell that he is on a certain line extending through a point between the two stations.

He doesn't know just where on the line he is located. So he tunes in another pair of stations and finds a line leading from them.

Where the two lines cross on the loran map is his position.

The key of the whole system is the time interval. It varies because the signals from the two stations have different distances to travel. This "travel time" changes the length of the original time interval.

Finding a position with loran takes less than five minutes. It is accurate within one percent (one mile possible error at a distance from the stations of 100 miles).

A "fix" obtained by sighting the sun or the stars takes 30 minutes. If clouds or fog prevents celestial observation on the high seas, the navigator may have no choice but "dead reckoning," which means that he must plot the speed and direction of the ship for days on end in foul weather and hope that he is within 10 miles of where he thinks he is.

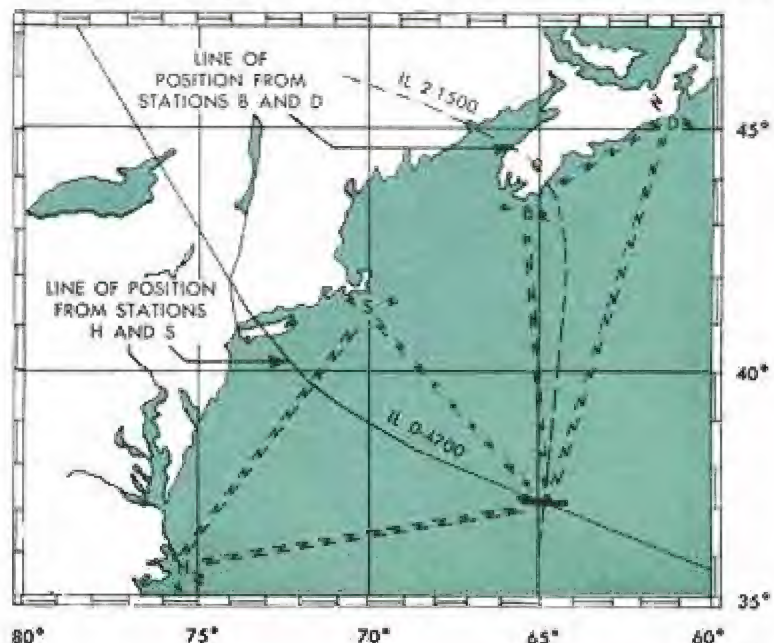
The speed with which loran "fixes" can be made is especially valuable to pilots, for a plane travels at least 150 miles in the time it takes to make one celestial "fix."

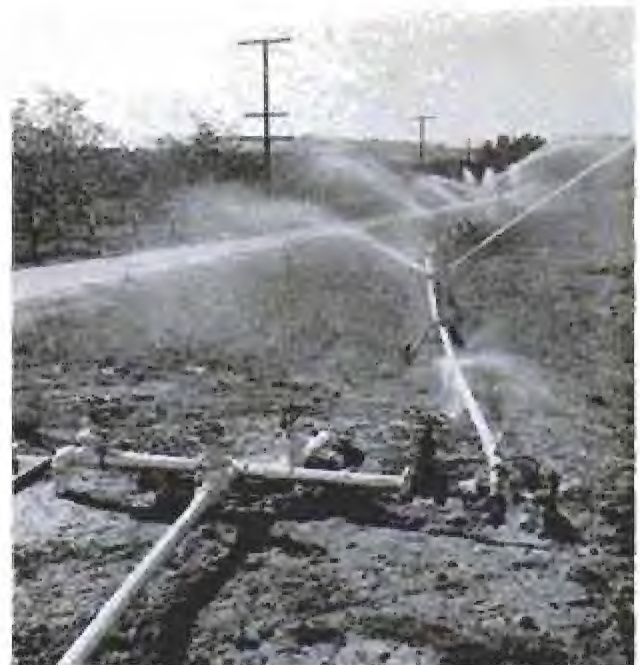
The experienced navigator

(Continued to page 226)



Top, loran station at Adak, Alaska. Tall poles support the transmitting antenna. Above, monitor crew in loran station checks scopes. Below, loran lines of position cross at ship's position. Loran-set readings are matched with lines on loran map





One man can move 400 feet of system, which is designed for turf crops such as clover, without strain

Flexible Neoprene sleeve joint between pipes is reinforced with glass fibers to take 300-pound pressure

Mobile Sprinkler System For Irrigated Farms

Mobile sprinklers for irrigation systems are not new, but many older types have disadvantages which are eliminated in a system just developed. It is so portable that one man can pull 400 feet of the pipe with little effort. Lengths of pipe are connected by a glass-fiber-reinforced, flexible Neoprene sleeve which will withstand 300 pounds of pressure. At the connection point, the pipes are mounted on a wheeled carriage which permits the entire pipe to be turned in a 30-foot arc. To avoid any torque or other excessive stress that could damage the pipe, all angular movement at this point is provided for in a universal joint. Thus, when the pipe is bent or pulled, the universal joint—and not the Neoprene sleeve—takes the stress. The system is designed so that the sprinkler heads and standpipes are always vertical. Since the sprinkler never touches the ground, a minimum of foreign material gets into it.



Drawings Made With Etching Ink "Cut" Stencil for Mimeographing

Greater versatility in reproducing artwork and lettering is possible on a duplicator stencil "cut" with a brush. A special etching ink, applied with an ordinary artist's brush, prepares the stencil for duplicating. After the ink is blotted, the stencil can be used immediately on the mimeograph.





Liquid Rubber and Powder Combined to Make Pliable Concrete

After a new concrete hardens, a thin slab can be rolled by hand into a tube without breaking. Mixed like regular concrete, the substance consists of powder and liquid rubber. After mixing, it can be troweled or buffed and can be used on standard concrete, metal, brick, tile or glass. It is intended primarily as a finish coat or for repair work on floors with heavy loads or

heavy traffic; it also may be used to dampen the shock and noise of heavy machinery. Laid in $\frac{1}{4}$ -inch layers, the concrete withstands compressive loads up to 2500 pounds per square inch. It resists alkalis and mild acids and is waterproof and slipproof. It hardens in a few hours and is completely cured in two or three days. It also resists cracking over a wide temperature range.



Dispenser for Fish Worms

Fishermen around Helena, Mont., can drop 50 cents into a converted soft-drink dispenser and receive three dozen worms in return. Bernard M. Chaffin and Ross Allen, Jr., developed the "Worm-o-Mat" to provide anglers with bait day or night. The machine is an ordinary soft-drink dispenser in which the coins unlock one end. Instead of bottles, milk cartons are used. The machine holds 450 cartons of worms at a cool temperature.

Lift-Measuring Instrument for Military Planes

For the first time, military aircraft are being equipped with an instrument which tells the pilot the best speeds to use for landing, take-off and other low-speed flight conditions. The Fairchild C-123B assault transport is equipped with a lift-measuring instrument. On take-off, the instrument tells the pilot the exact speed at which the plane should become airborne, and the best initial climb under the existing weight and power conditions. A fingernail-sized vane on the lower edge of the wing senses changes in wing lift, and this information is passed along to the instrument on the panel.





CITROEN SPRINGS SOME SURPRISES

with the first model change in 21 years

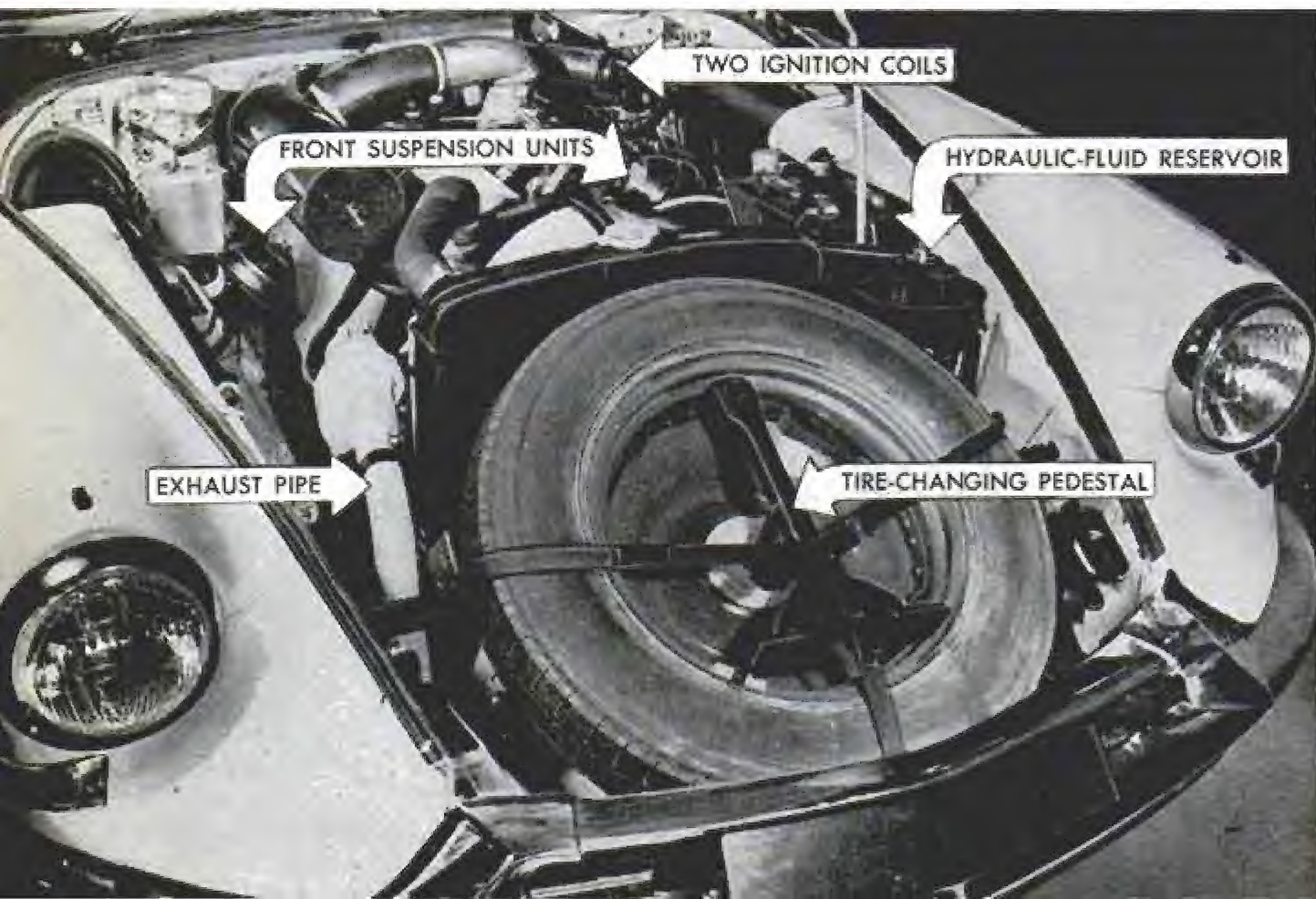
By Arthur R. Railton

CITROEN is different! It's as individualistic as the average Frenchman who, incidentally, loves the car with a devotion that approaches fanaticism.

Looking at the pictures on these four

pages will convince you that the Citroen DS 19 is different. It is even different in its basic philosophy—this is the first time in 21 years it has changed body styling. Even more unbelievable is the fact that,

Lift the hood and get the first of a succession of surprises: The spare tire is in front of the radiator





Suspension is at low point here; dotted outline shows its high point. Driver can select any height he wants

despite the arrival of the new DS 19, the factory continues to build and sell the 21-year-old body style, too!

But there are greater differences that you can't see—engineeringwise.

Consider suspension. It has an air-oil system by which the passengers literally ride on air. There are no metal springs between the wheels and the body. The body actually floats on compressed air, giving it a softness that smooths out the roughest roads and yet, by some miracle, hangs on like a sports car in a fast corner.

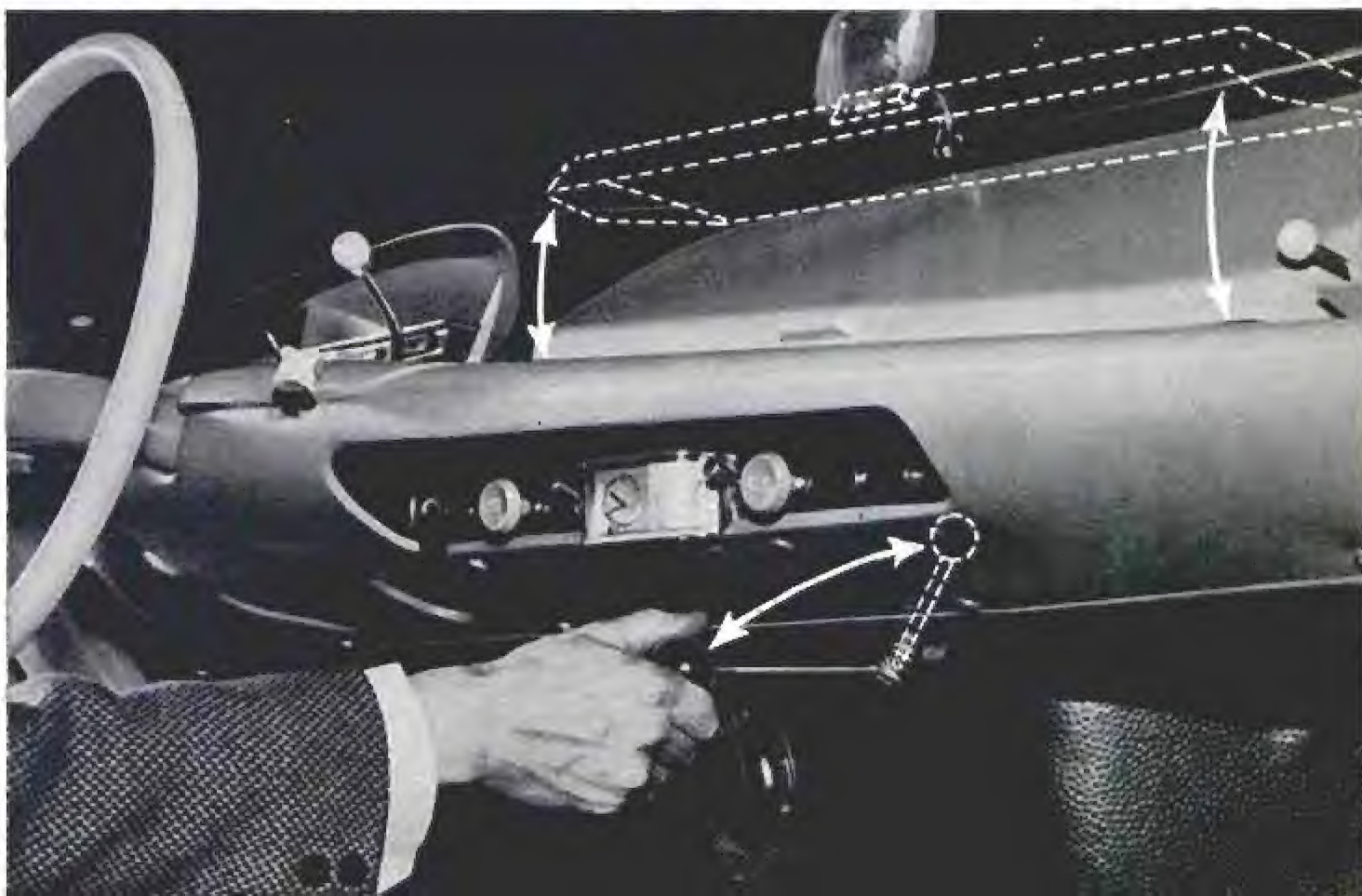
The body remains at a constant level regardless of load and this level is adjustable

CITROËN'S CENTRAL HYDRAULIC SYSTEM



For a detailed explanation of the world's first central hydraulic system, as featured in the new Citroën DS 19, see page 192 of the February 1956 issue of *Popular Mechanics*. The full-page diagram explains the system and shows the layout of the 115 feet of tubing by which a single pump powers brakes, suspension, transmission and steering

Handle (arrow) operates windshield wipers should motor fail. Top of dash lifts up to uncover big glovebox





Steering wheel has no spokes! Actually it is attached to an extension of the column. Grille visible is fresh-air inlet



To use the ash tray, you pull out the clock. Below, some of the controls. Suspension control adjusts height of the body



so that in deep snow or on a rutted road the driver can raise the body several inches to keep from "belly-ing." As if that isn't enough, the same air-oil suspension lets you "jack up" the car without a jack!

Key to the air-oil suspension system is the Citroen's new central hydraulic system—the world's first, by the way.

What's that, you ask? It means that all power accessories (power brakes, steering, clutch, gear-shifting and suspension) are powered from one pump—a small cylinder about half the size of the generator on your car. The pump maintains hydraulic pressure in the system. From it radiate 115 feet of tubing to carry pressurized fluid to all parts of the car. Such a system is predicted for the cars of the future, but the Citroen has it today!

The ignition system is different, too. It doesn't even have a distributor. There are two coils for the engine's four cylinders instead of the usual one. The only timer required is a make-and-break device that never needs adjustment and which, by the way, is completely waterproof and will operate underwater.

Of course, Citroen has been famous since 1934 for its front-wheel drive. The advantages: An unbelievable cornering ability that has made Citroen the favorite quick-getaway car; and (more important to the passenger's comfort) a completely flat and underslung floor that requires no bothersome hump or tunnel to cover a long driveshaft.

Citroen with its new DS 19 has solved one problem that has plagued front-wheel-drive cars for years: too large a turn circle caused by limitations of the universal joints. The DS 19 will turn inside a 35-foot circle, considerably more maneuverable than any American car of its size.

The pedal for the power brakes is about as big as the dimmer switch on your floorboard. But the differences don't end here. The Citroen braking system has a sensing valve that maintains the correct amount of braking front and rear regardless of weight distribution. As the car is loaded, the valve adjusts the relative braking to allow for the change in load.



With no tire or differential in the way, the trunk is amazingly deep. Note the unusual shape of trunk lid

The front brakes are disk, mounted in-board to reduce unsprung weight to a minimum. Citroën claims to be the first company to mass produce a car with disk brakes that are self-adjusting for wear. Rear brakes are conventional (a word not often used in describing the DS 19).

As a safety measure, the parking brake is applied with the left foot on a large pedal. This pedal is connected mechanically to the front disk brakes and provides an excellent brake should the hydraulic system fail.

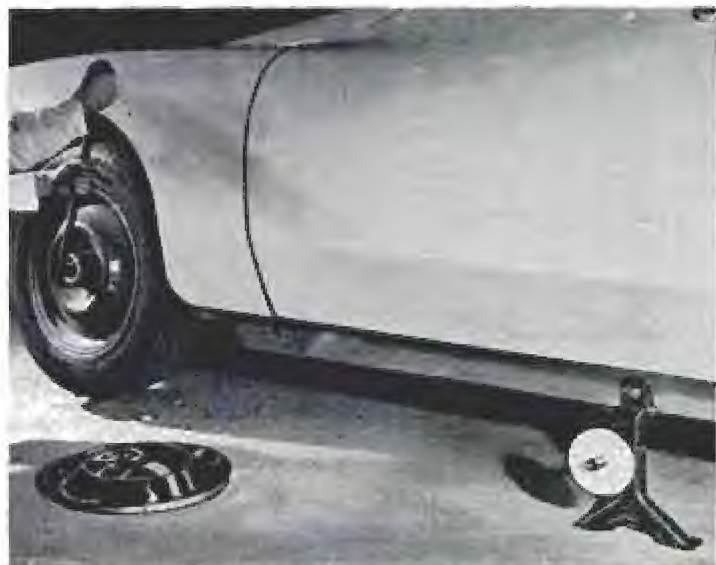
The spare tire is carried ahead of the

(Continued to page 230)

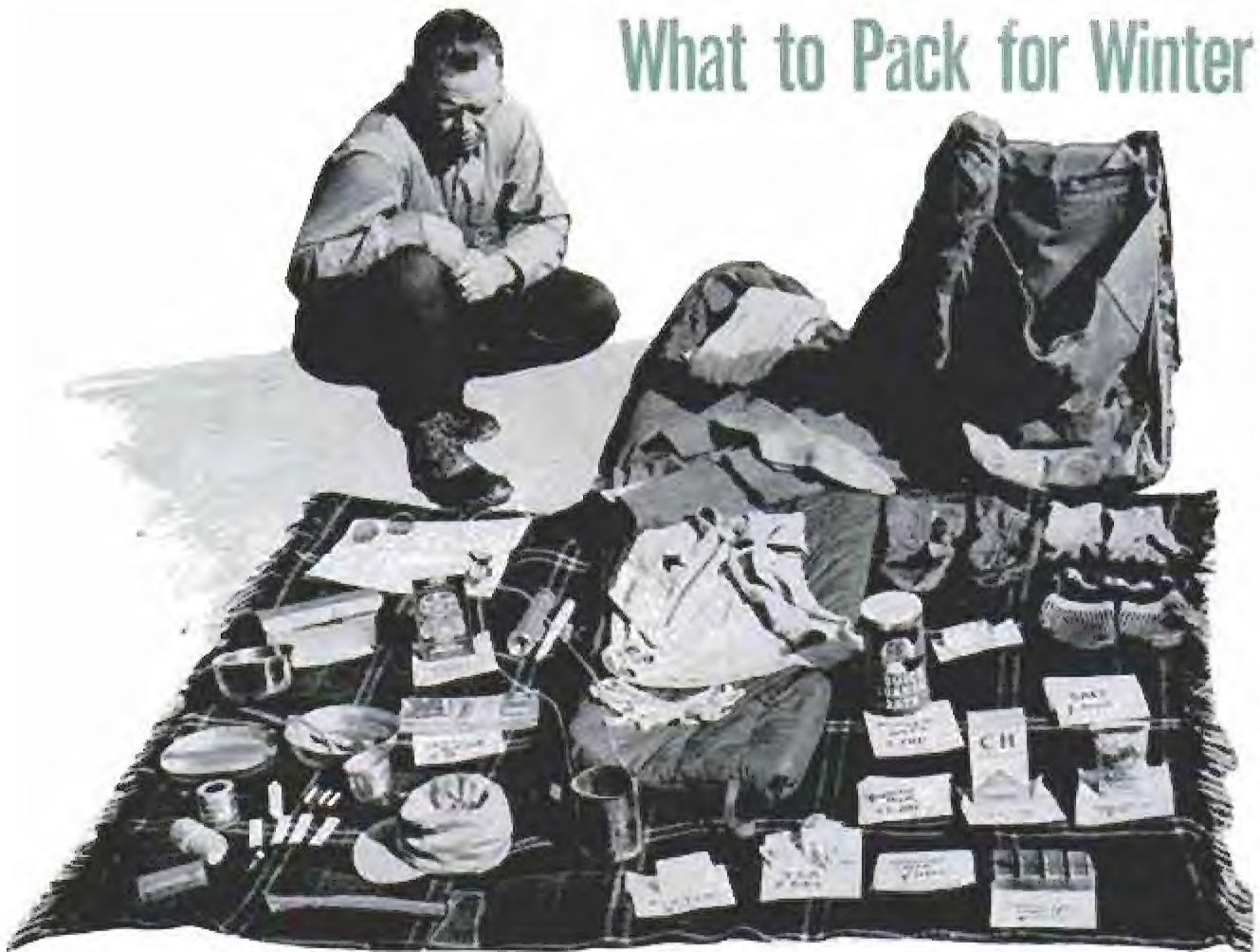
To remove a rear fender, you loosen one bolt (arrow). Two pins hold forward end in place



To change tire, you fit pedestal in slot (right), flip the suspension lever and wheel goes up. One nut secures wheel



What to Pack for Winter



WHAT EQUIPMENT will you need for a winter day's camp in the wilderness? Readers have asked us to give a detailed list of the equipment in this ranger's kit, shown in the photograph which appeared originally in the January article, "Stay Alive in the Great Outdoors," by James Joseph. Here are the specifications for the ranger's full winter field kit. Food portions are for one day: for longer trips multiply by the number of days, and vary the menu.

Ranger is wearing:

- Medium-weight khaki shirt
- Woolen trousers
- 2 pairs woolen socks
- 8-inch snowshoe pacs
- 2-piece woolen underwear

He carries:

- 2 pairs woolen inner-liners for gloves
- 1 pair of leather mittens
- 2 pairs of woolen socks
- Change of two-piece woolen underwear
- Nylon poncho
- Long-billed cap (Perhaps also a woolen cap)
- Water-repellent parka which should fit over pockets and hips
- Trapper Nelson or traditional rucksack
- Light down sleeping bag

Miscellaneous:

- Pocket compass
- Pair of dark glasses
- Map of country he's camping
- Hand ax
- Flashlight and extra batteries
- Candle
- Waterproofed matches (dipped in paraffin)
- Waterproof matchbox
- "Billy" can with wire handle (from quart can)
- Pocketknife
- Pitchwood for fire starting
- 30-foot nylon cord for erecting shelter, binding windbreaks

Medical:

(No first-aid kit. Individual items easier to pack)

- 2-inch adhesive tape (for sprains, blisters)
- 2 or 2½-inch elastic restrictive bandage
- Triangular bandage (for arm slings)
- 2-inch roll of gauze
- 4 capsules of Merthiolate
- Stick of lip medication
- 4-6 small prepared bandages
- Toilet paper

Utensils:

- 1 frying pan with collapsible handle
- Standard Boy Scout or Army mess gear, with knife, fork and spoon
- 1 set of nesting cups
- Quart pot (optional)

Food:

(Portions shown are for one day of camping. Multiply by the number of days out and vary the menu)

- ½ pound sliced bacon
- ½ pound dried fruit
- 4 ounces salted crackers
- 4 ounces butter (optional)
- 6 tea bags
- 4 ounces American cheese
- 4 ounces sweet chocolate
- 3 ounces powdered milk
- 4 ounces sugar
- 1 cup rolled oats
- 1 ounce salt
- 2-6 bouillon cubes



Manhattan in Miniature To Take World Tour

In nine years, Miller has built 185 miniatures of major downtown-Manhattan structures. Four more years are needed to complete his project



Guy Cleveland Miller wants to take Manhattan Island and all of its 58,503 buildings on a world tour. Since the real thing isn't portable, he's building a scale model. Working from sketches, photographs and memory, he has completed 185 of the more difficult downtown structures in nine years of steady effort. He estimates it will take another four years to complete the other island buildings. Materials used in construction include old boxes, real glass, water colors and balsa wood. This is Miller's second city-building project. He made his first when he was only 12 years old.

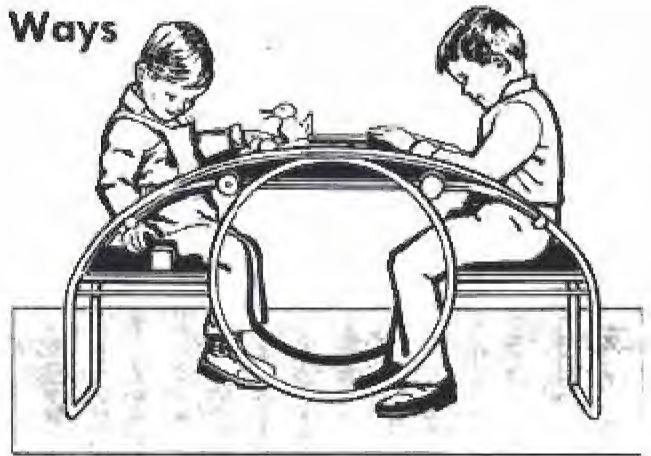
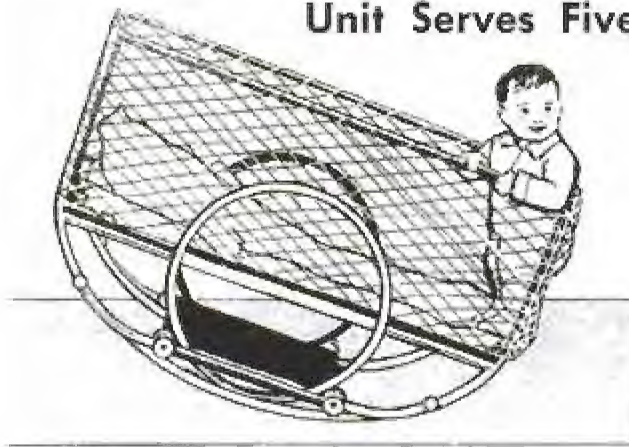


Traffic Kindergarten Teaches Safe Driving

Impressed by the rising automobile accident rate, authorities in the French sector of Berlin have established a permanent traffic kindergarten as a regular part of the school curriculum. Toy automobiles and bicycles are driven through a miniature street layout, and pedestrians as well as drivers receive instruction from regular West Berlin traffic policemen. Traffic lanes, sidewalks, main and side streets simulate actual conditions. One corner of the 4000-square-yard area is equipped with chairs, desks and blackboards so that lectures may be given by the policemen.



Unit Serves Five Ways



Five different functions are performed by a piece of furniture which "grows with the child." Its curved tubular-steel framework makes it ideal as a cradle. Retractable legs are turned down to make it into a

bed. Later, simple adjustments make it into a rocking toy with seats for two. Turned upside down, the toy is a chair and a table for two. When the child is grown, the table becomes a flower and knickknack stand.



Freight-Car Scale Signals Retarder

Freight cars coasting toward the master retarder in a classification yard are weighed by a small device attached to a rail section. It sends signals to the retarder which slows the car to the proper speed. Three settings—under 35 tons, 35 to 55 tons, and above 55 tons—determine how much pressure is needed to slow the car. The system frees the yard operator from any necessity of controlling the retarder.

Aluminum Framework for Tent Does Away With Ropes and Poles

You need no ropes or poles to support a tent that has a lightweight aluminum framework. The framework is slipped together in minutes without the use of tools. Since there are no center poles, there is

more living space within the tent. Once erected, it can be moved by two men to a new site without dismantling. The folded tent and disassembled framework easily fit into a duffel bag.





Located atop Germany's highest mountain, this TV antenna picks up clear pictures from transmitter 68 mi. away

Mountain-Top Television Room

Sportsmen visiting the "Schneefernerhaus" atop Germany's highest mountain, the Zugspitze, can now enjoy television in the evening after skiing for the day is finished, thanks to a new antenna installation designed for the spot. Despite the mountainous terrain clear pictures are received from a transmitter 68 miles away. To achieve this, the receiving antenna had to be aligned perfectly with the transmitting antenna.

Weary skiers relax and watch television in the lounge of the "Schneefernerhaus" after day of strenuous activity in the Alps



East German Front-Wheel-Drive Car Has Plastic Body

With its engine mounted ahead of the radiator, a small East German car, the P70, has an all plastic body. The two-cylinder

engine is mounted crosswise directly behind the front bumper. It drives the front wheels. Top speed is 56 miles per hour.





Man on a power pole symbolizes this electrified farm in Idaho, where 20 motors streamline the chores

Electric Farm Hands Take Over the Chores On a 400-Acre Farm

Clogging is avoided in the feed mixer by an electric heating system that keeps the molasses flowing

By Rafe Gibbs



TWO SHOVELS leaning against a barn of the Meyers brothers' place near Sugar City, Idaho, stand like symbols. The brothers, Marvin, 49, and Wayne, 48, have one of the most electrified farms and stock-feeding enterprises in the West, and they don't have much use for shovels any more.

To see the Meyers place is to see the new West . . . a West that has tamed its bucking rivers with dams, and now rides their bridled horsepower. On the Meyers' 400 acres of intensified production are more than 20 different electrical motors—none for frills, all for better farming. There are also two electrical heating systems; one for warming the water in stock drinking troughs, the other for heating molasses before mixing it in feed.

We talked with another farmer in the county.

"Yes," he said, "Marv and Wayne run an efficient place. I'm glad, though, I don't get their electric bills."

Although the farm at the time had a con-



Wayne and Marvin Meyers stand at nerve center of their electrified farm, where 260 horsepower is harnessed

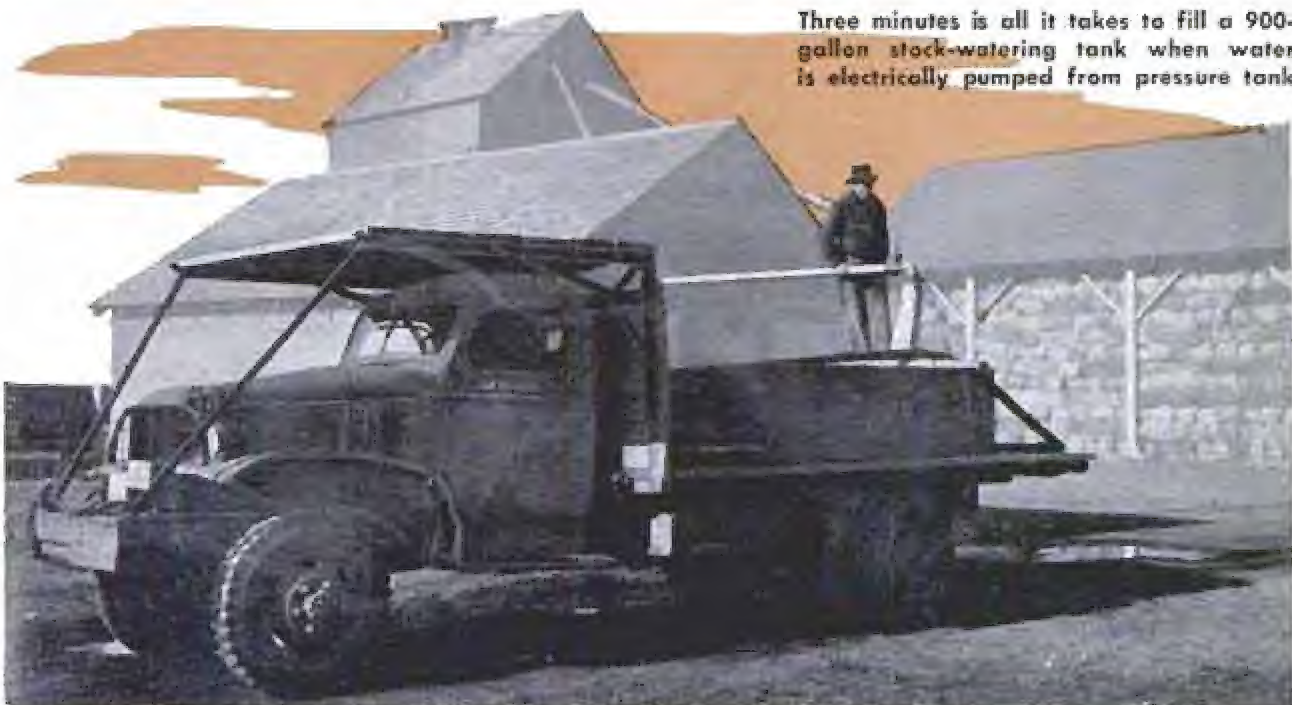
needed load of 260 horsepower, those bills—even in the peak months—totaled no more than \$100 to \$145. And the man-hours, the money saved. . . .

The Meyers brothers annually fatten some 25,000 head of sheep, 2000 head of cattle. That means a lot of water is needed and, as portable sheep pens are constantly being moved, all water to the sheep is hauled by truck. The brothers started out with a 1½-horsepower motor pumping from an old well, but it took 45 minutes to fill a 900-gallon tank on a truck. Two men and two vehicles were needed to haul water. This was too slow and too expensive.

The brother-partners—a slim, sandy-haired, high-voltage unit in themselves—dug a new well, and installed a 1000-gallon pressure tank and a pump with a 10-horsepower motor. Now only one man and one truck are needed to haul water. We held a watch as the truck driver filled his 900-gallon tank. Three minutes flat. Cost of electricity for filling that tank was about 1½ cents.

The farm has water pressure (60 pounds per square inch) equal to that of many small towns. It has a cart with 350 feet of hose connected to a ¾-inch nozzle that shoots water 100 feet in the air. In 30

Three minutes is all it takes to fill a 900-gallon stock-watering tank when water is electrically pumped from pressure tank





At the left, a portable worm takes the place of shovels in handling grain. Above, automatic scale weighs grain for mixing. Push of button does the rest

seconds, a stream of water could be poured on a fire any place in the barnyard.

Insurance companies figure 90 percent of major-loss farm fires could have been put out with minor damage if city-hydrant water pressure had only been available. It is on the Meyers farm.

Studies conducted by the University of Idaho college of agriculture showed that stock gains on chopped alfalfa averaged 12.1 percent greater than on long alfalfa. Playing the percentages on the 2000 tons of hay they feed annually, the Meyers brothers decided in 1946 to install a big-scale chopping system.

Soon purring on the farm were a three-horsepower motor for dragging baled hay into a breaker, a 15-horsepower motor for breaking the bales, a 100-horsepower motor for chopping the hay, a 30-horsepower motor for blowing the hay into a shed, and a 7½-horsepower motor for operating a "worm" to draw the hay into a scale hopper.

Inspired by the success of the hay chopping, the brothers determined the next year to eliminate entirely hand-mixing of feed. They were tired of shoveling in the granaries — breathing and eating dust — guessing wrong on feed proportions and watching sheep die as a result of that guessing. Death losses were running about three percent.

More motors came to the Meyers place, and it now has the nearest thing to push-button farming. One man flicks switches and pulls levers, and the mixing is done.



No job is too small to be done by electricity, as long as Meyers brothers can see it will save manpower

It's as easy as that. The ingredients, from grain to sugar-beet pulp, are automatically weighed, and the proportions are right. Death losses, as a result, were cut to 1½ percent.

A huge magnet pulls out any metal particles that may have gotten into the feed. A blower shoots the feed into second-story bins. Top-hinged doors on the side of the barn swing open to let the feed pour into

a truck for transporting to the livestock.

Blending of sugar-beet molasses in the mix in January was literally a sticker until the Meyers installed an electric heater. Now the molasses flows freely with the temperature outside below zero.

With all the various switches to operate in the mixing shed, one would think that sometimes the wrong switch would be

(Continued to page 234)

Some secondhand pipe, a ½-horsepower motor and a little ingenuity provided farm with gasoline pump

Automatic waterers for cattle are heated in winter to prevent ice. Cattle feeding is year-round business





Lachlan MacLeay, 162 feet long and 45 feet wide, has a draft of 5½ feet, plies between St. Louis and Omaha

Missouri River Towboat Destroys Sand Bars

WHEN A SAND BAR blocks her way, the newest and most powerful towboat on the Missouri River digs her own channel. Normally the *Lachlan MacLeay* pushes her barges. But she can move up front to wash a sand bar away with her four propellers, each driven by a 900-horsepower engine.

Huge rudders under her stern increase her maneuverability. Four main steering rudders, each 5 feet high and 10 feet long, aft of the propellers, are used when the boat is moving forward. Six flanking rud-

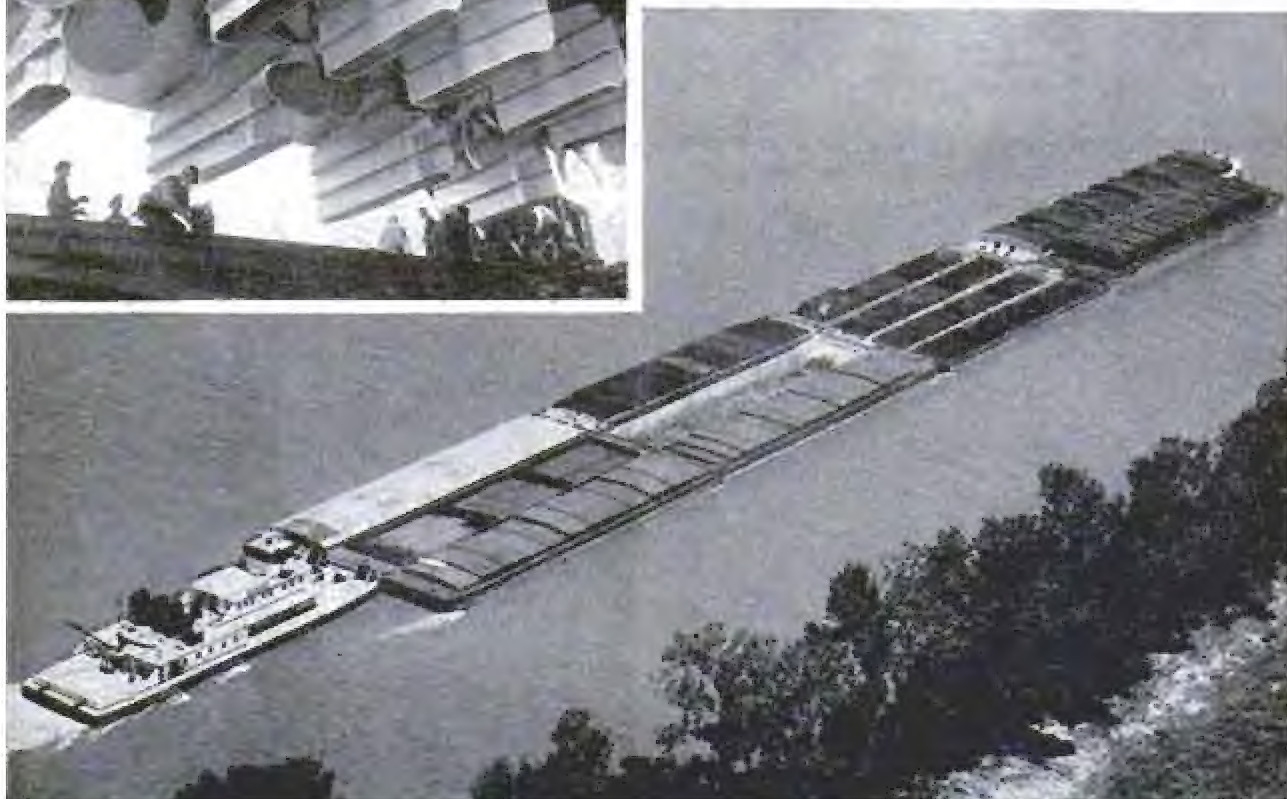
ders forward of the propellers are used in backing.

The boat has a draft of 5½ feet, one foot less than the shallowest parts of the channel between Omaha and Kansas City.

The boat, 162 feet long and 45 feet wide, is part of the Federal Barge Lines fleet. She can handle tows as long as 1000 feet and as wide as 105 feet, weighing 10,000 tons. A unique feature of the *MacLeay* is the arrangement of her four stacks, placed side by side behind the pilothouse.



Four main steering rudders, left, aft of propellers, are each about 5 by 10 feet. Six forward rudders are used when boat is backing. Below, boat can handle line of barges 1000 feet long, 105 feet wide. Four stacks side by side behind pilothouse vent engines



Piggyback Truck

Low bridges over the right of way don't bar the rail transport of a German truck trailer designed for piggyback hauling. It doffs its wheels once it has been driven onto a flatcar. Hydraulic legs fitted to the box of the trailer lower it to within a few inches of the car floor. The undercarriage is nested together at the rear of the trailer.



Torpedo Transistor

Transistors replace vacuum tubes in an ultrasonic control system that "homes" a torpedo in on its target. The compact, rugged transistors, unlike tubes, do not require a separate source of high-voltage power but operate directly on the low voltage of the torpedo battery. Their power requirement is $\frac{1}{10}$ that of tubes. The transistorized control dispenses with the usual 30-second warm-up period.



Splices for Cables Come in Kits

Factory-perfect cable splices, hermetically sealed in epoxy resin, can be made in the field with a splicing kit produced by the Minnesota Mining and Manufacturing Co. The kit contains spring electrical contacts to make the actual splice, a three-piece plastic mold and a plastic bag containing the resin and a hardener. To make the splice the wires are connected by the contacts, the mold is placed around them, and the resin, mixed with its hardener in its own bag, is poured into the mold. The resin hardens in 5 to 15 minutes. The splice is said to be completely weatherproof.



Paper-chromatography sheet shows various patterns made by different inks as they spread out from center



Crime Detectives *Solve* Chemical "Fingerprints"

By Thomas E. Stimson, Jr.

Here is how chromatography sheets are made. Solvent drawn up from reservoir by cylindrical wick spreads across ink spots to separate each into bands. Below, Kirk and his ink and ball-point-pen samples



NEW TOOLS for catching criminals are being perfected at the University of California.

Two techniques now allow quick and easy identification of various substances, and can be used even by small police departments not equipped with crime labs.

They have the cumbersome names of "paper chromatography" and "paper electrophoresis." Used principally by biochemists, they are being adapted to the field of crime detection by Dr. Paul L. Kirk, professor of criminalistics at U.C.

By means of paper chromatography a criminologist can scrape a tiny sample of ink from a document, then quickly compare its "fingerprint" with another sample to learn if the two are identical. The method takes advantage of the fact that an ink spreads out into colored bands or lines when mixed with a solvent and placed on filter paper.

One black ink may separate into characteristic red, blue and yellow bands, for instance, while another ink that appears identical may produce entirely different gradations of color, depending upon its ingredients. Of two dyes in an ink, one is more solvent than the other, hence is transported a greater distance on the filter paper. Butyl alcohol is a common solvent. Water, phenol, acetone and ammonia also are used as solvents.

Paper electrophoresis is similar except that the solvent is allowed to creep downward on a sheet of filter paper at the same time that an electric current flows across the paper. The current makes a sideways distribution of the materials carried by the solvent, forming a characteristic pattern of bands or spots. Distribution is based on the tendency of particles to migrate in directions depending on their electrical charge. Doctor Kirk uses the method to compare samples of such substances as dried blood, paints, metals and various poisons, even in tiny amounts.

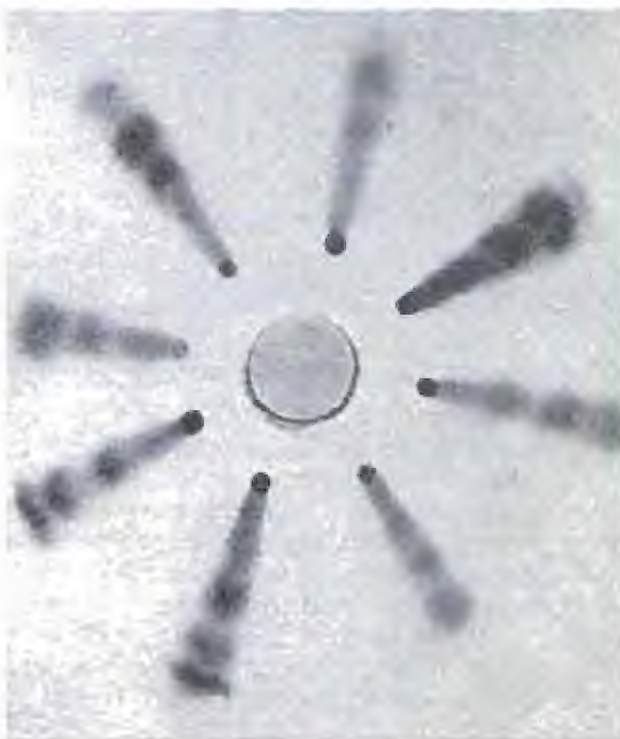
Studies of inks include ball-point inks, mimeograph inks, typewriter ribbons and even printing inks. There is a hint that the comparative ages of inked writing can be determined even though made with the same ink.

Another field that Doctor Kirk is investigating is the possibility of identifying a person from a sample of his blood, even though dried. The pattern of disease and infection on the blood antibodies appears to be different in each person. It is already possible to show the difference between two persons by means of blood samples and Doctor Kirk expects that ultimately a person's blood will serve to identify him just as precisely as do his fingerprints. ★ ★ ★



Electric current flows across filter paper in the electrophoresis method, separating the ingredients

Ink pattern produced when solvent was allowed to flow across ink samples consists of various colors

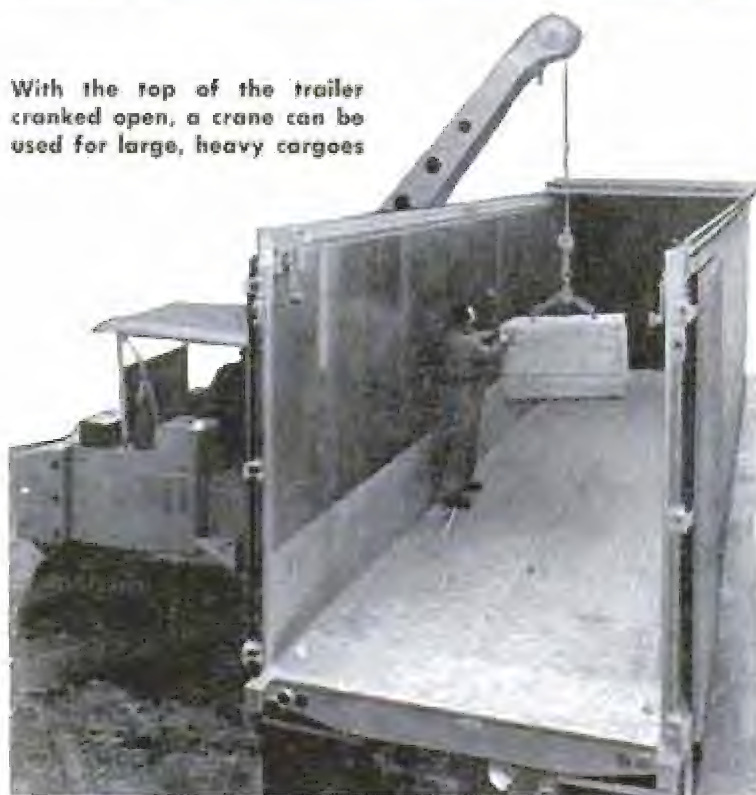


Truck Trailer Has Sliding Roof For Overhead Loading



The driver turns a crank to open the sliding roof. He can vary the opening as much as necessary until two thirds of the trailer compartment is exposed. Since the roof slides either to the front or back, the entire compartment can be made accessible

With the top of the trailer cranked open, a crane can be used for large, heavy cargoes



Like the top of a crayon box, the entire roof of a new kind of truck trailer can be slid forward to permit easy loading from above. With the top open, a crane can be used to swing machinery, large crates and other bulky objects into the trailer. To operate the sliding roof, the driver turns a crank at the front of the trailer. He can stop the roof at any point and can extend it until as much as two thirds of the trailer compartment is exposed. The roof also can slide toward the back, opening the front of the compartment. The trailer is weatherproof when the roof is closed because the roof overlaps the slide runners, making a weathertight seal. Loading heavy cargoes by crane, as compared with loading through a side door, is expected to reduce trucking costs by cutting down on time spent in loading and unloading trucks.

Telephone Cable to Hawaii

California and Hawaii will be connected for the first time by telephone cable when a \$35,000,000 project is completed in 1958. The twin cable, the world's longest, will have three times the capacity of the present radiophone circuits. It will allow 36 simultaneous conversations. Amplifiers built into the cable at 40-mile intervals will boost the signals. A start is being made this year on a similar cable between Port Angeles, Wash., and Ketchikan, Alaska.

Scientists Make Synthetic Virus

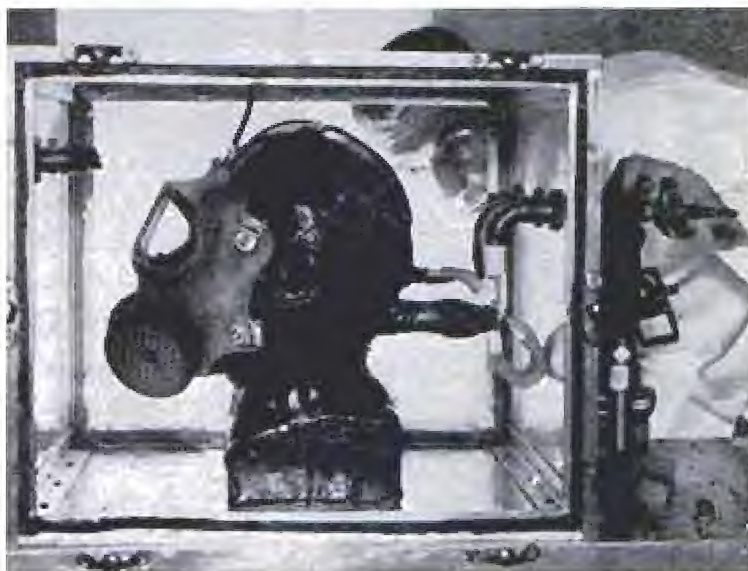
University of California scientists recently announced that they have achieved the first partial synthesis of a virus, which may be a major milestone in the fight against virus diseases. Taking inert fragments of viruses, they put them together to form active viruses capable of causing rampant disease. Using this method, it may be possible to "tailor make" viruses which are capable of imparting immunity and yet incapable of causing disease.

KEEPING UP WITH THE ATOM

SCIENTISTS at the University of California at Los Angeles have established a "clearing house" to sift information on the atomic nucleus from laboratories all over the world. Human and electronic brains process the information. The studies indicate that the nucleus does not have a sharp edge. Dr. David Saxon, who directs the group of physicists, compares the nucleus to a ball of yarn with a very fuzzy edge, or to a cloud whose trailing edges gradually disappear into the blue. He describes the assault on the atom with cyclotrons and other instruments as "like trying to determine the shape of a house in the dark by bouncing tennis balls off it. Neutrons and protons fired by these atom smashers are like luminous tennis balls. By noting the way the balls bounce we are beginning to get an idea of the shape of the atom's core."

This basic research will provide a foundation for applied engineering in the future. For example, the Army is looking for a way to power huge overland trucks with atomic energy. Most likely use for the trucks would be to haul a string of trailers in a "land train" to supply bases in isolated areas. One engineer estimates the atomic engine for such a truck would have to be 10 feet wide and weigh about 100 tons. Shielding to protect the crew would account for much of this size and weight.

Protection of personnel got a boost on another front with the development of a rubber head (above) by General Electric



scientists to test face masks which protect atomic workers from radioactivity. Pumps fitted to the head "breathe" through the mask. A filter inside the rubber windpipe collects any radioactive particles that manage to get through the mask. In this way the mask's efficiency can be tested.

Further protection for workers is provided by what is probably the world's "hottest" safe (below, left). Built at the Hanford, Wash., plant, the safe is a 15-ton cylinder. The floor vault is used to store "hot" samples of uranium which have been subjected to chain reaction in a plutonium-producing reactor. The samples are stored on cylindrical shelves under a steel lid 10 inches thick. When a worker wants a sample, he turns a wheel which rotates one of the shelves below him. This brings the desired sample in line with an access hole. A one-ton lead cask then is placed over the hole, and a claw mechanism seizes the sample and lifts it into the cask.

Radioactive materials—in tracer amounts—are now being used to tag insecticides. Some stubborn insects have resisted all the new insecticides. By using the tracers, scientists can follow the course of an insecticide through the insect's body. This research yields clues as to how an insect can convert a poisonous substance into a harmless one. Scientists then may be able to develop poisons that the insect can't resist.





With a dump body attached, the machine can lift 2¼ tons and load it to any height up to 14 feet. The 80-inch tread of the versatile machine is designed to fit between rows of particular crops the inventor cultivates



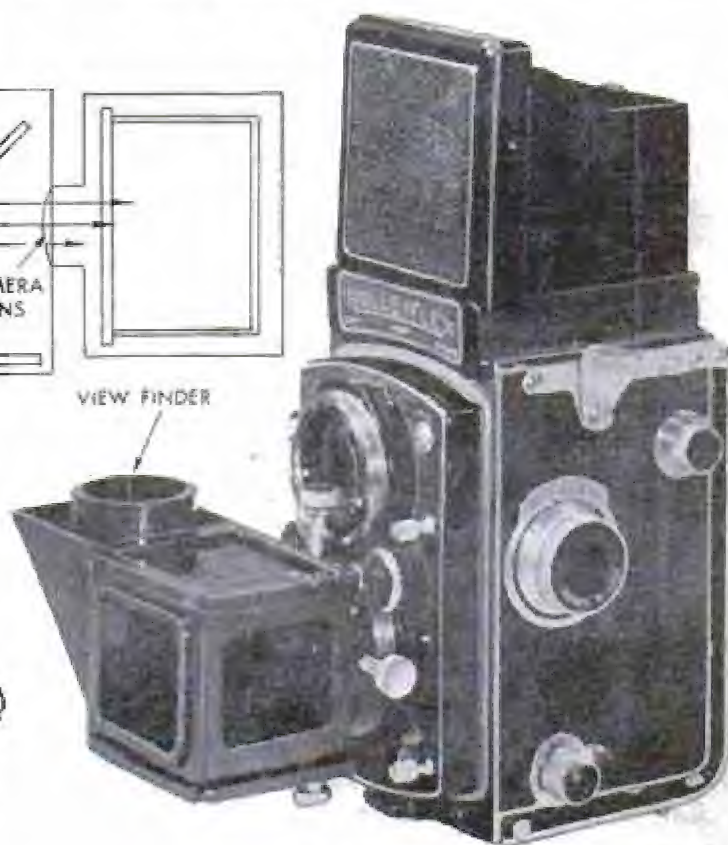
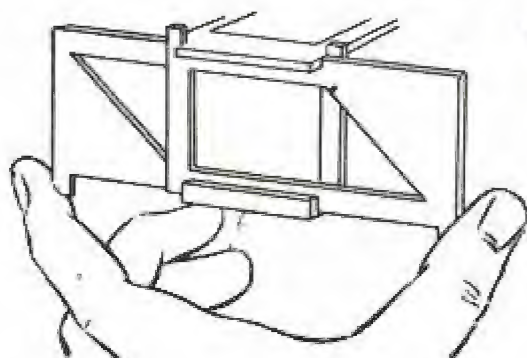
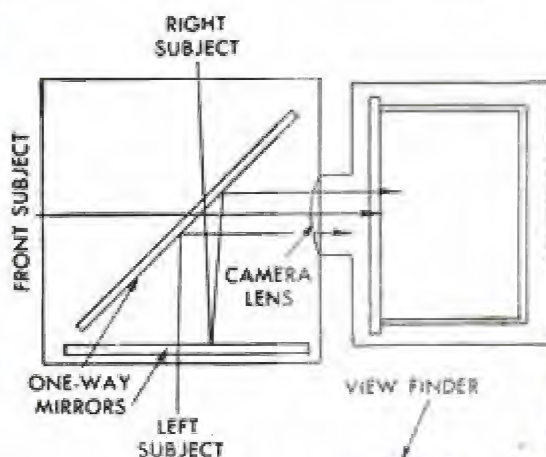
All-in-One Farm Machine

Almost any job around his farm is easier for Donald E. George of Greenfield, Calif., now that he has built a versatile, all-purpose machine. The machine combines the functions of a tractor, dump truck, lumber carrier, spray rig, cultivator and harvester. It also may be used as a fork lift or fitted with a bulldozer blade. A rear-mounted 1937 Plymouth engine powers the machine. Two transmissions and a two-speed rear end provide 38 forward speeds and 10 speeds in reverse. The machine operates at ⅓ to 20 miles per hour.

Attachment Enables Camera to Shoot Pictures From Three Sides

You can make intentional double or triple exposures with an attachment that fits on the lens of a still or movie camera. The objects to be combined are placed at either side and at the front of the unit. In-

side are two one-way mirrors, so placed that rays of light from all three sides pass through them and are reflected into the camera lens. A view finder on top shows when to shoot.



RADIO *Television* ELECTRONICS

Build Your Own Hi-Fi Speaker Enclosure

By Lothar Stern



WHILE THE PHONO cartridge, the amplifier and the loud-speaker represent the "meat" of any high-fidelity music system, the speaker enclosure certainly adds the "flavor." Like a well-balanced meal, which would taste flat without salt and other seasonings, even the finest hi-fi system sounds lifeless and unnatural unless the speaker is properly housed and baffled.

The enclosure is more than just a housing for the loud-speaker. It actually provides the means for transferring the vibrations of the speaker cone to the surrounding air, so that the resultant sound waves are produced with maximum efficiency.

Particularly effective at the low audio frequencies, a properly designed enclosure makes it possible to hear bass tones which would otherwise be highly distorted, if not altogether lost. Thus, the enclosure becomes a vital part of the hi-fi system, one which must be engineered with the same precision as any other component.

Available in kit form, Electro-Voice line of enclosures includes a wide variety of styles to match any single or multiple-speaker combination



THE PATRICIAN



THE BARONET



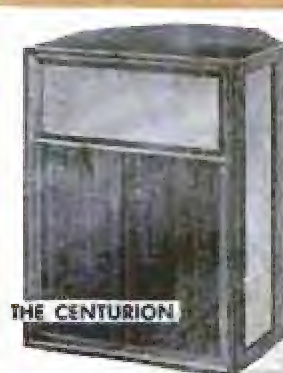
THE EMPIRE



THE GEORGIAN



THE REGENCY



THE CENTURION



"Karlson" enclosure shown in rough and finished form combines unusual styling with outstanding performance. Available for 8, 12 or 15-in. single or multiconed loudspeakers



Above: Latest enclosure kit by University Loudspeakers, Inc., White Plains, N. Y.

Like all other items of custom-built furniture, commercially assembled hi-fi enclosures are relatively expensive. In fact, the purchase of a good enclosure may make a sizable dent in the budget of the average music lover. Realizing this, many manufacturers have gone into partnership with the do-it-yourself fans by making their enclosures available in kit form at a tremendous saving. The manufacturer furnishes the design, materials and complete assembly instructions, while the purchaser supplies the few hours of time required for assembly of the cabinet. The kits, when properly constructed, are capable of performance comparable in all respects to their commercial counterparts.

One manufacturer of high-fidelity-speaker

(Continued to page 248)

Below: Disassembled Cabinart "Rebel" enclosure, long-time favorite with high-fidelity enthusiasts

Below: Original Klipsch-designed "Shorthorn" corner enclosure is now available as a do-it-yourself kit

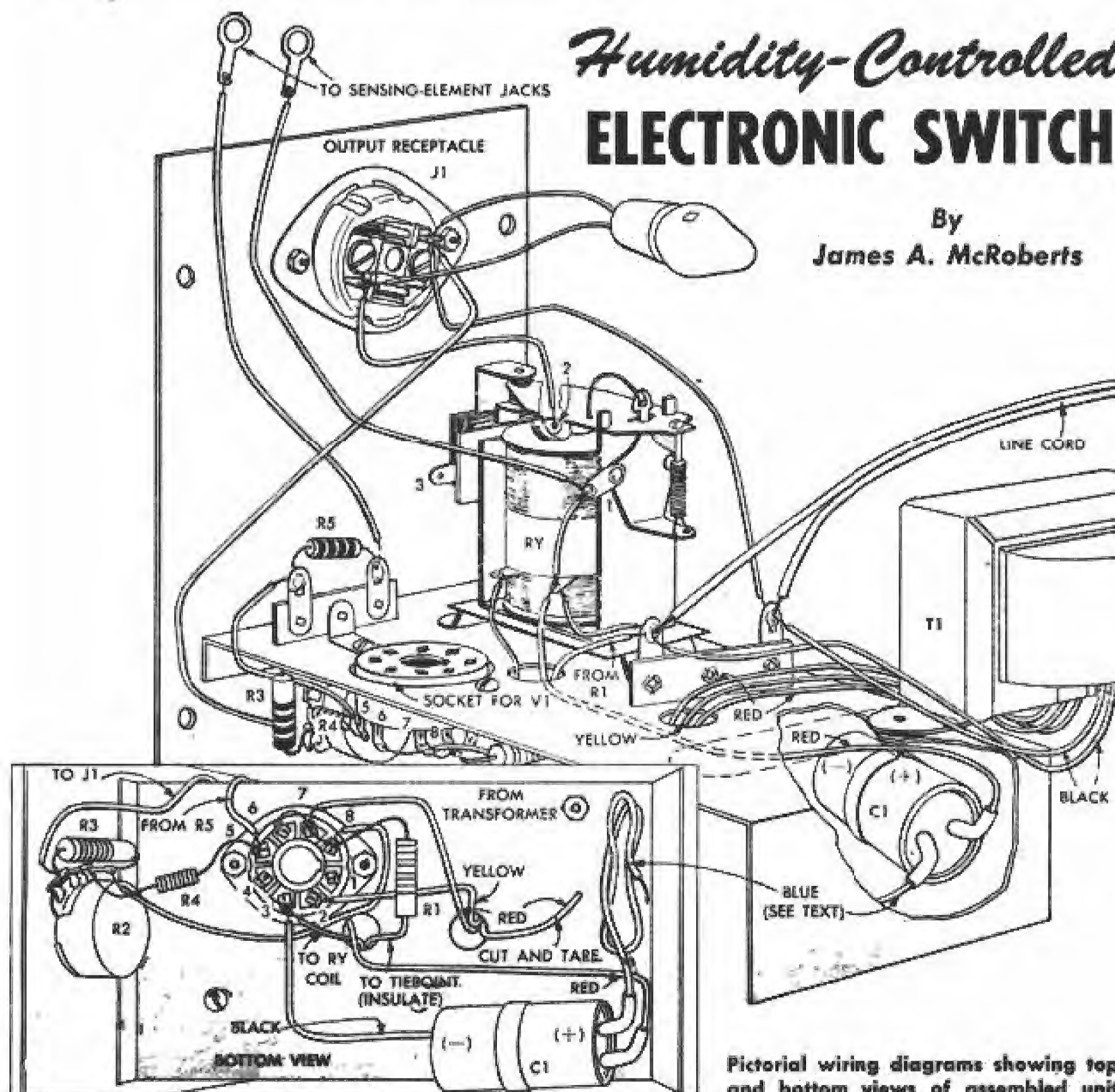


Simple to build and foolproof in operation, this inexpensive control uses a unique sensing element for the detection of humidity changes. It is well-known that ordinary table salt can readily extract moisture from, and return it to, the atmosphere. In doing this, the electrical resistance of the salt varies over a wide range. This change in resistance is utilized to control the firing of a thyatron which, in turn, closes or opens a set of relay contacts to control the external unit.

The operation of the electronic switch is explained with the aid of the schematic diagram shown on page 164. The resistor, R1, in series with sensitivity control, R2, forms a voltage divider across the a.c. line. During the positive half cycle of the applied line voltage, the cathode of V1 is more positive than the grid, which is connected to the variable arm of



By
James A. McRoberts



Pictorial wiring diagrams showing top and bottom views of assembled unit



A second path across the a.c. line consists of the lower part of R2, R4, R5 and Rx (sensing element). The current flowing through R4 applies a voltage to the grid of the tube to counteract the original bias. When the resistance of Rx is high, the current through R4 is small and the applied grid voltage is insufficient to bring the tube out of cutoff. However, when the resistance of Rx is reduced, as the salt in the sensing element collects moisture, the voltage drop across R4 will increase. This increased voltage drives the tube into con-

Since salt absorbs moisture somewhat more readily than it returns it to the atmosphere, a bulb is used to apply a small amount of heat underneath the sensing element to compensate for the normal time lag. The bulb is lit only during the "on" cycle of the relay.

The construction details are illustrated on page 163. The assembly is built into a commercially available metal case with a built-in chassis. Assembly should begin by mounting the larger parts to the chassis and front panel. When mounting the sensitivity control and a.c. receptacle, be sure to leave enough clearance at the top and bottom so that these will not interfere when the chassis is inserted in the case.

(Continued to page 252)

Schematic diagram of the humidity-controlled electronic switch. The sensing element is described in text





Designed by John Hergon

BUILD YOUR OWN GREENHOUSE

FOR THE PROPAGATION and healthy growth of plants and the production of seedlings for spring planting, there's nothing quite as effective and satisfying as a greenhouse. A separate structure, or true greenhouse, is preferable as it more nearly serves the twofold purpose of propagation and display of plants. However, a lean-to built against the house or garage, or over a basement window, offers safe growing conditions for many common seedlings, cuttings and also for the display of plants not hardened to sudden temperature changes. The one disadvantage of the lean-to type is that it is not always possible to locate it to take full advantage of light and heat from the sun.

True Greenhouse

A separate structure like that pictured above is the choice of experienced gardeners. It offers a much better opportunity for proper management of the house during the

growth period of most plants and a better utilization of available sunlight during the season. Note from the following pages that ordinary storm sashes form the glass roof and that both ends of the structure are glazed. The sashes are shown hinged at the top. If desired they also can be hinged at the lower ends. If this is done, each sash should be fitted with a storm-sash bracket so that it can be locked in the open position. The size of the structure detailed permits use of two 3'-0" x 6'-0" storm sashes on each side of the gable. When selecting these be sure there are no pronounced ripples in the glass panes. Ripples in the glass may tend to concentrate the sun's rays and damage plants.

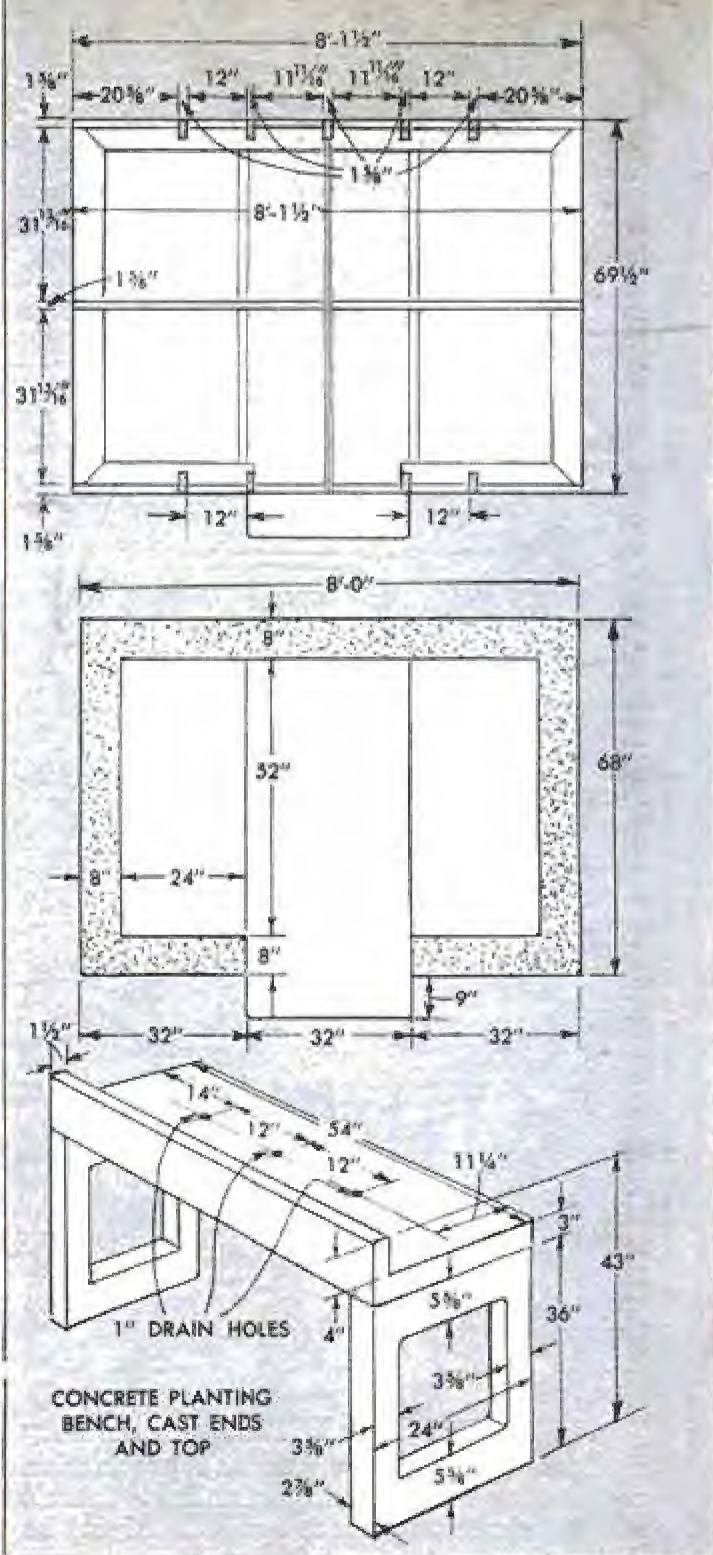
In the sectional detail of the house, page 167, the foundations are shown without footings. In stable soils this construction is permissible. But in loose loam and in sandy or gravelly soils the foundation should be on a footing about 6 x 12 in. in sectional



Above, separate structure, or true greenhouse, is most suitable for all-around use of experienced gardener. Center, lean-to greenhouse includes a potting shed

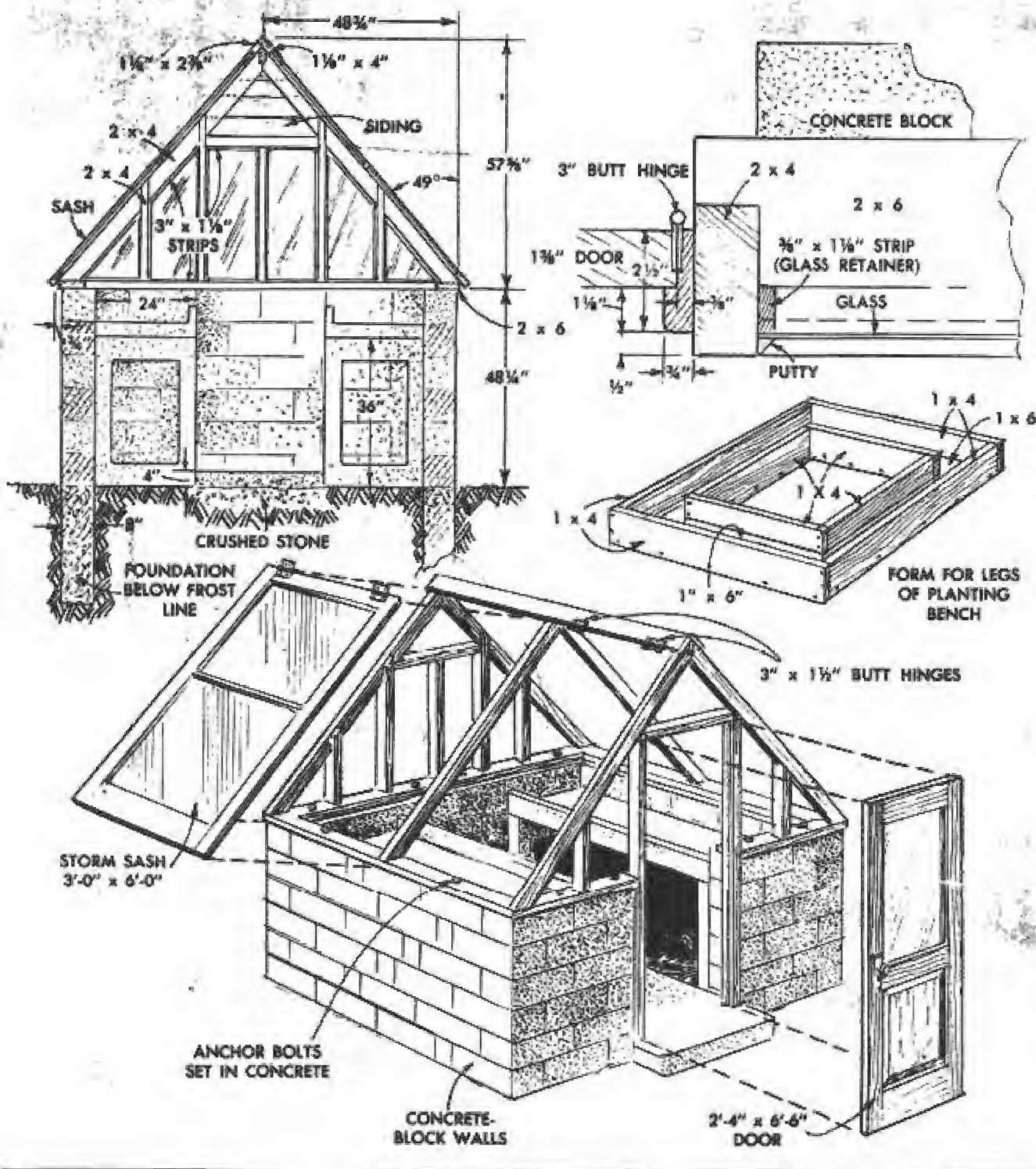


Window greenhouse serves as starter for transplants



size. The cast-concrete planting benches detailed above and on the opposite page can be omitted and planting benches constructed of cypress substituted. These can be constructed inexpensively and in considerably less time. If you do cast the benches of concrete be sure to reinforce the top either with reinforcing rods or wire mesh.

The walls can be laid up of cinder block, concrete block, or natural stone. Fill the voids in the top course of blocks with cement mortar and rubble (small stones or coarse gravel) and insert anchor bolts before the mixture hardens. The bolts provide a means of attaching the 2 x 6 plates securely to the wall. When laying the blocks be sure to bed each one in sufficient mortar



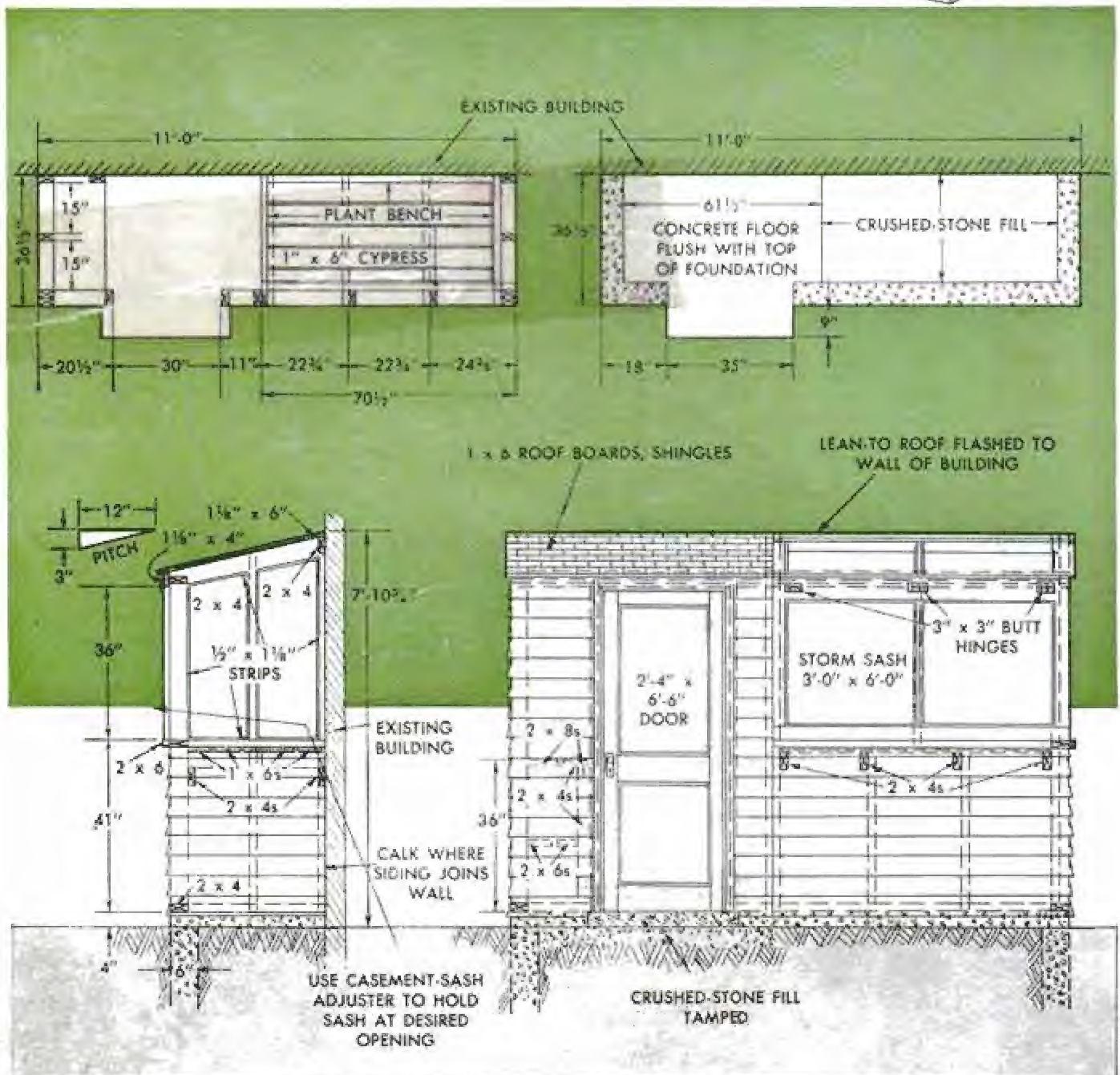
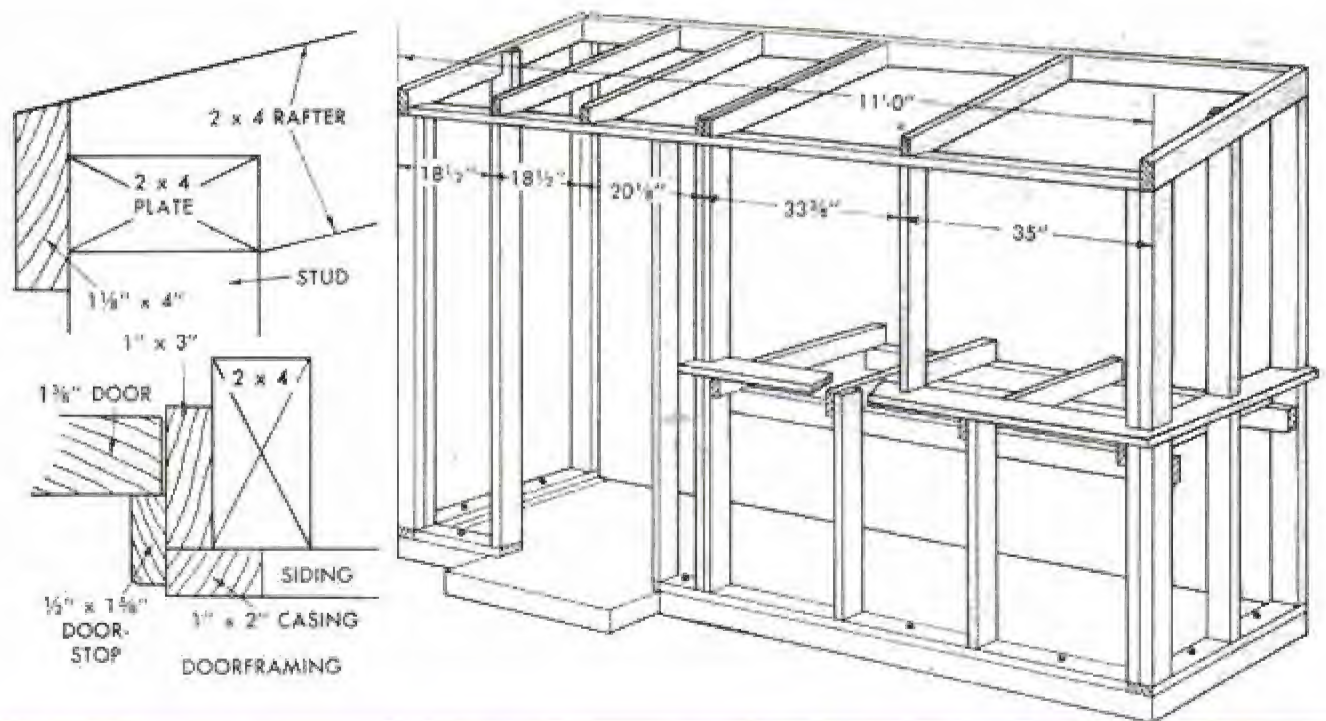
to assure watertight joints of maximum strength. Keep each course of blocks level and the corners plumb.

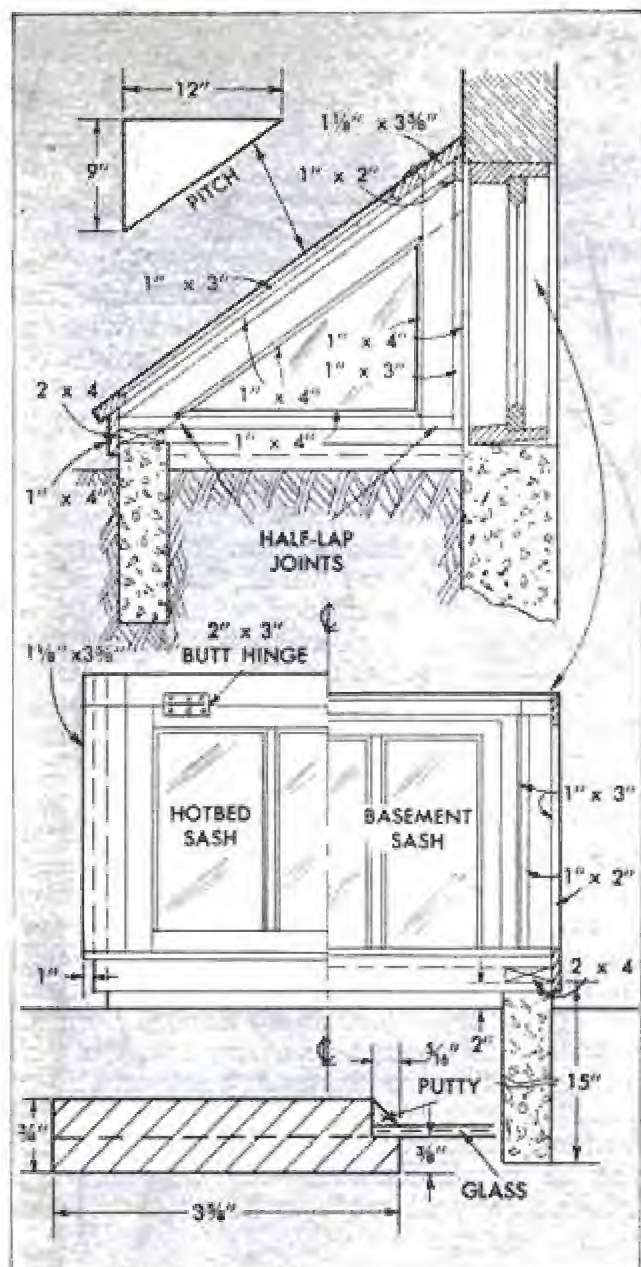
Cut all wooden parts of the structure to finished size, trial-fit each one, then prime with a suitable primer, making sure that the priming coat covers all surfaces, especially the end grain. Give the priming coat time to dry thoroughly, then bed the 2 x 6 plates in mortar, allow the mortar to set partially and tighten the nuts on the anchor bolts. Note that the plates are notched to take the 2 x 4 uprights that form the side jambs of the doorframe. The top jamb is end-lapped onto the upright side jambs. The sectional detail through the doorjamb shows the door hinged to swing in. This assembly can, of course, be re-

versed and the door hinged to swing out, if desired. To avoid cutting triangular pieces of glass to fit over the header in the rear gable and over the top jamb above the door, these areas are covered with siding as indicated.

Lean-to Greenhouse and Potting Shed

This unit is designed to be built against the house or garage where space is available for a southern exposure. It should not be built under a wide cornice. Sills of the structure are bolted to a concrete foundation poured to a depth well below the normal frost line. Studs, plates and rafters complete the framing ready for siding and roof boards. The concrete floor, poured over a tamped gravel fill, is an optional





feature. The greenhouse half of the structure is housed with two standard storm sashes and the end is glazed as detailed. The potting bench and plant bench can be made in any way that best suits the pur-



pose. Cypress wood is the most durable because of its ability to resist rot.

Window Greenhouse

For starting seedlings in flats and for advancing the growth of certain house plants which are to be reset out of doors later in the season, a window greenhouse is ideal. The details giving the construction of this unit are not fully dimensioned as certain changes may have to be made when fitting it to the basement window. Note in the construction details that the ends are shown glazed to admit the maximum amount of light. The unit should be located on the south side of the house.

Heating

Unless used during the four seasons, the lean-to and window greenhouses will not ordinarily require heat. In an emergency a small electric heater will serve for the lean-to in the early spring and late fall months. To utilize the separate greenhouse to the fullest a reliable source of heat is necessary. In all except the more severe climates a small greenhouse usually can be adequately heated by means of lead-covered electric heating elements. ★ ★ ★

Rough-Water Outboard Refueling Easy With Motor Oil Can

A quart-size outboard-motor oil can filled with an emergency supply of gasoline is easy to pour into a sputtering engine in a rough sea at a time when it is impossible to stand up and pour from the standard 2 1/2-gal. can. With the can painted red, marked with an "O" to identify it and filled with outboard fuel mix, all that is necessary in an emergency situation is to unscrew the lid and tip the open spout into the filler hole of the motor's fuel tank. When under way again the quart can is easily refilled from the large fuel can, and is ready to use once more if necessary.

Ivan Grosvenor, Indian Rocks, Fla.



Cabinet Combines Incinerator and Refuse Can



Solve the rubbish-disposal problem at your house with this sturdy incinerator and garbage-can holder faced with sheet steel riveted or bolted to angle-iron corners. The top is equipped with a hinged screen cover of welded flat iron which prevents fiery material from flying. Two lengths of steel pipe are welded across the incinerator chamber to form a grate on which is placed a standard wire-type rubbish burner. Beneath the basket is a galvanized clean-out pan that also acts as a draft intake. The handle shown in the illustration just above the clean-out pan is one of

four installed so the cabinet can be easily carried by two people. On the other side of the steel center partition is a space for the garbage can which rests on a shelf attached to the door. Door is made from wood paneling covered with thin galvanized sheeting and swings on heavy butt hinges. A finger latch prevents stray cats and dogs from prying open the door, and as a protection against rodents, a steel floor should also be installed. Sturdy and long lasting, this cabinet will prove to be a worthwhile home-shop project.

George R. Harrison, Valparaiso, Ind.

Spinning Black-and-White Disk Makes Visible Colored Rings

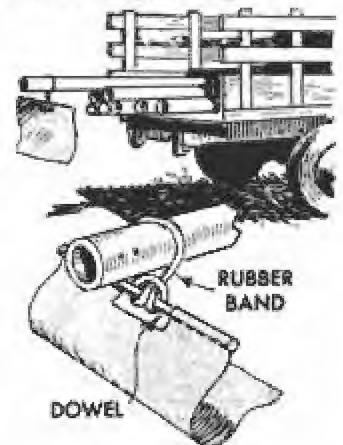
Spin this black-and-white disk and it will appear to have several colored rings painted on it. To try it for yourself, first cut out the design and glue it to a piece of cardboard. Then drive a nail through the exact center of the disk to provide a shaft on which it can spin. Convinced, you can make an enlarged design with drafting ink on a piece of cardboard, keeping the spacing proportional in size. Rotating the disk in an opposite direction will reverse the color scheme.



Projecting Load Warning Flag

When loads of pipe, lumber, or other materials project beyond the truck bed you can warn other motorists with this easily attached flag placed at the rear end of the load. One edge of a piece of red cloth is sewn to a wooden dowel rod to keep it spread out, and a heavy rubber band, cut from an inner tube, is looped around the center of the rod through a hole cut in the cloth. The rubber band stretches easily over the end of a pipe or piece of lumber thus eliminating the need for tacking or tying.

Hugh Lineback, Stillwater, Okla.





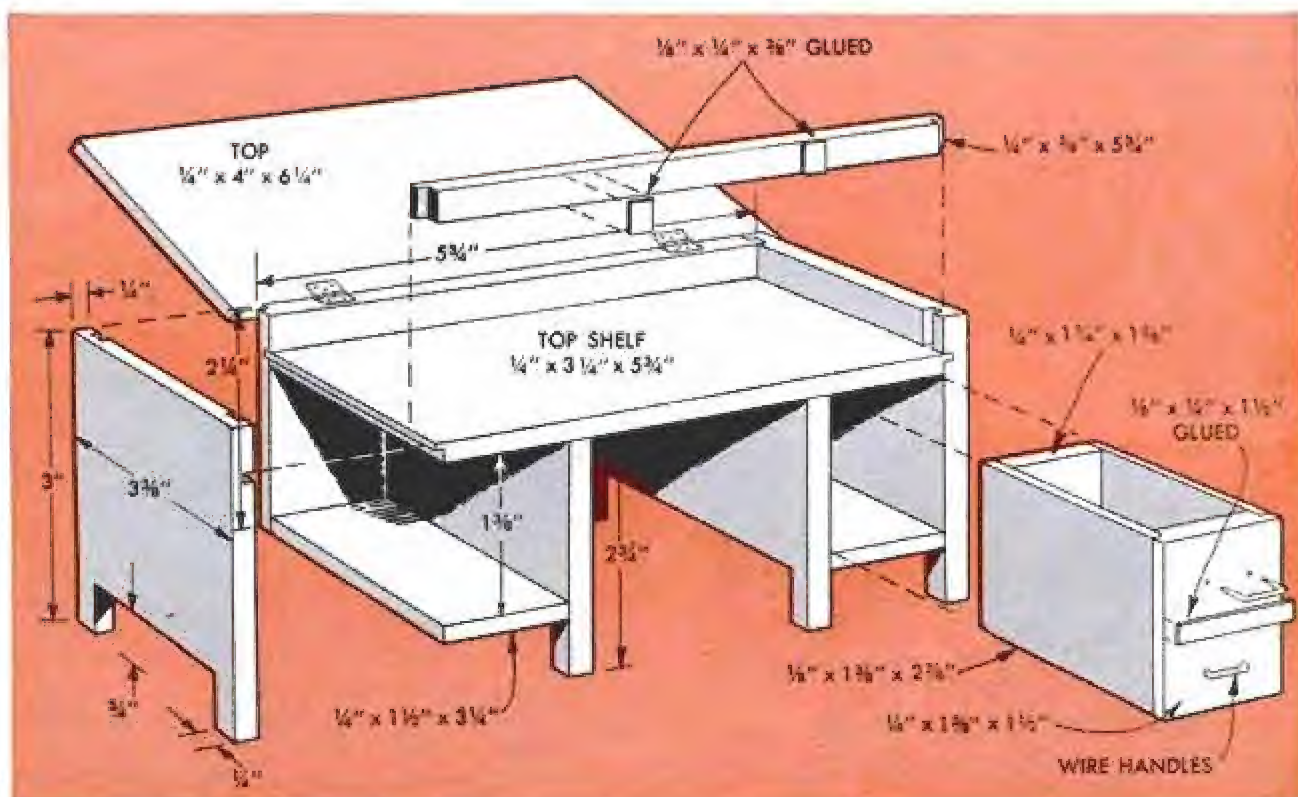
MINIATURE DESK

is cigarette holder

FOR AN ATTRACTIVE novelty that can be used in your living room or office, make this miniature desk. It has a practical use as well. A hinged lid covers a shelf of cigarettes, and two small drawers that slide open as in a full-size desk provide a handy place to keep rubber bands, paper clips, stamps and other small objects. Cut all parts for the desk from hardwood according to the dimensions given below. After the desk is glued together, stain the surfaces to bring out the grain and apply a coat of varnish. For the drawer handles bend short lengths of brass wire into staples with square corners.



After glue is applied to joints of all fixed parts of desk, fasten clamps in the positions shown above



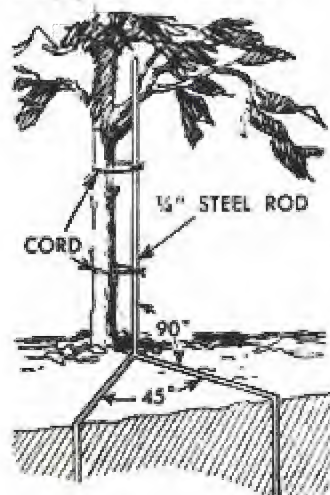


Embossed Auto-Lamp Lenses Cleaned With Toothbrush

The deeply embossed lenses of automobile backup lights and taillights can be cleaned easily by scrubbing them with a discarded toothbrush dipped into a mild soap-and-ammonia solution. The mixture is made by dissolving a teaspoonful of soap flakes in a half pint of water and then adding a teaspoonful of household ammonia. After all dirt has been scrubbed loose, the lens and surrounding areas should be thoroughly rinsed with clear water, wiped dry and polished with auto wax for added luster and easier cleaning next time.

Walter E. Burton, Akron, Ohio.

Reusable Metal Standards Support Plants



of rod, the other spreader is welded to the bottom of the upright. The ends of the spreaders are bent down so they may be forced into the earth as shown.—Henry F. Kangieser, Palo Alto, Calif.

Stowaway"

By Bertram Brownold

EASILY DISASSEMBLED for compact storage, this attractive inlaid chess table is ideal for a small apartment, or wherever living space must be utilized fully. The legs pull out of sockets on the underside of the table top, then themselves are pulled apart, resulting in eight short sections that fit into a rack on the underside of the top. The sides of the rack are formed by two compartments which have sliding lids and provide storage for the chessmen.

Start construction by cutting a 15 x 15-in. square of $\frac{3}{8}$ -in. plywood. Next, four hardwood blocks $\frac{1}{2}$ x 3 x 3 in., in which 1-in. holes are drilled, are glued and screwed to the underside of the top at the corners, $\frac{5}{8}$ in. in from each edge. Cut out the parts of the boxes, assemble them and glue and screw into position. Use flatheaded wood screws and countersink them so they do not interfere with the wood squares of the playing board which are glued over them.

Before installing the squares, B, fit the table top with a mitered frame. The frame

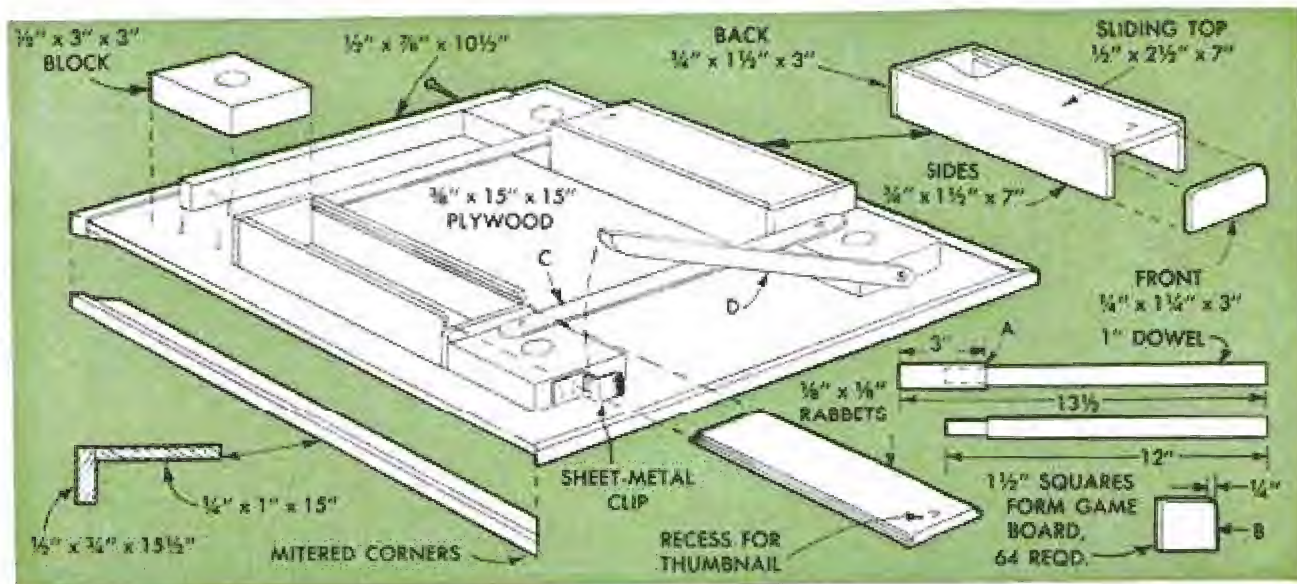


Above, mitered frame of table is glued and held in place with clamps until glue has set. Below, since frame and squares of playing board cover screwheads, leg blocks are screwed to underside of table top first



Chess Table

stock is glued up from two pieces as indicated in the lower left-hand detail. Light-colored wood is used for 32 of the 64 squares and dark-colored wood for the other 32. Light-colored wood can be used for all, by staining half of them dark. Each table leg consists of two 12-in. lengths of 1-in. dowel joined by a 3-in. ferrule, A, made from 1-in. brass tubing. Pin or screw the ferrule to one leg section. The two crosspieces of the leg rack, C, are cut from $\frac{3}{8}$ -in. plywood and measure $\frac{3}{4} \times 8\frac{3}{4}$ in. Locking strip, D, measures $\frac{1}{2} \times \frac{7}{8} \times 10\frac{1}{2}$ in., as does the fixed strip at the opposite end. When the table is completed, sand it smooth and give it several coats of varnish. For easy cleaning, apply wax. ★ ★ ★



Below, after frame has been glued in place, squares for playing board are brushed with glue and carefully fitted in place, resulting in attractive inlay

Below, two-piece legs fit neatly in rack on underside of table top. Two boxes which form sides of leg rack also provide neat storage for the chessmen



Fix your Wagon for Roughing it

By William B. Barry



Any station wagon can be equipped with two comfortable bunks without sacrifice of inside storage space

STRETCH those vacation dollars and stop where and when you please by living aboard a station wagon that has bunk beds for two, cooking facilities and all camping gear neatly stowed inside. After many years of camping I believe this method to be the most economical and care-free. A station wagon arranged in this manner permits one to walk through the car and out the tail gate without the usual obstructions. The bunks may also double as seats for carrying several extra passengers. Meals are cooked and eaten on the lowered tail gate, at which time two folding chairs serve as seats. During bad weather one bunk becomes a table and the other makes a very nice bench. Any station wagon may be rigged in the same way with slight variations in procedure, depending upon the seating arrangement.

Interior Rearranged

The first step in the conversion is to remove the spare tire and rear seats. The

wide driver's seat is taken out and the small folding rear seat is then converted to a narrow driver's seat by removing the two pipe seat supports and welding flat steel supports in their place to provide proper elevation and tilt, Figs. 7 and 8. Now the car is ready for installation of the storage boxes and bunk beds.

Two plywood storage boxes are made to fill the spaces behind the seats, Fig. 9. The boxes should be shaped to fit the slant of the seat backs and extend from the seats to the rear fender wells. The box behind the driver's seat is made smaller to permit long-legged drivers to push the seat back. The storage boxes must be set out from the wall a short distance to allow the lids to clear the slanting body line.

Making the Bunks

To obtain a pattern for each bunk deck, stretch one string across the rear end of the car at the desired level for the bunk tops and another between the front doors immediately in back of the front seats. Connect these two strings with a third and fourth string in positions that will indicate the upper, inside edge of each bunk for the length and height. Measure from the third and fourth strings to the wall at close intervals to determine the curve of the car body on each side.

The bunk decks are then cut from 1/2-in.

Meals are cooked and eaten on lowered tail gate, at which time two folding chairs serve as seats. During foul weather cooking is done inside, one bunk becomes a table and the other serves as a bench





All camping gear and other duffel are neatly stowed under bunk beds



plywood and fitted with hinged supports, Fig. 10. Each deck is attached to the storage box ahead of it with two small metal brackets. Use of continuous-type hinges makes it possible for the supports at the ends of the decks to be swung outward to facilitate removal of large pieces of luggage with the tail gate down, Fig. 10. Sash locks are used for securing the end supports to the hardwood runners on the car floor. The entire unit is assembled in the car for fitting and making minor adjustments and then disassembled so that it can be removed and the finish applied.

Insulating Storage Boxes

Next, install locks on the storage boxes and pad the walls with two layers of

Spare tires are mounted on auto-top carrier located toward rear of car for easy removal and servicing

corrugated paper to provide protection for camera equipment and other instruments. Because of its load-bearing requirement the bottom of each box is covered with a layer of cotton padding and an overlay of $\frac{1}{2}$ -in. plywood. This completes the interior alteration of the wagon. Ordinary lounge pads from outdoor furniture can be used for mattresses on the bunks.

Curtains and Screens for Windows

To assure privacy while dressing, draw curtains can be attached to the interior beading along the tops of the windows. At least two of the windows should be equipped with screens to permit ventilation yet keep out insects. The slip-on type screens currently available for some makes

The first step in the conversion is to remove the rear seats, spare tire and removable floor fittings





One of narrow back seats is converted to driver's seat to permit unobstructed movement inside car for convenience when en route or when wet outside



Two plywood storage boxes, shaped to fit slant of seat backs, extend from seats to rear-fender wells



Continuous-type hinges on supports at ends of decks permit easy removal of luggage stowed under bunks toward rear end of station wagon as shown above



Above, bunk deck is attached by metal brackets to storage box forward and is supported by a member at rear fender well and a hinged end support. A sash lock secures end support to wooden runner on car floor. Right, lounge pads from outdoor furniture make comfortable, lightweight mattresses

of cars can be used. Or, remove the garnish molding around a window, stretch mosquito netting over it and replace the molding for an alternate method of providing screens. Operation of the window will not be impaired by either type of screen.

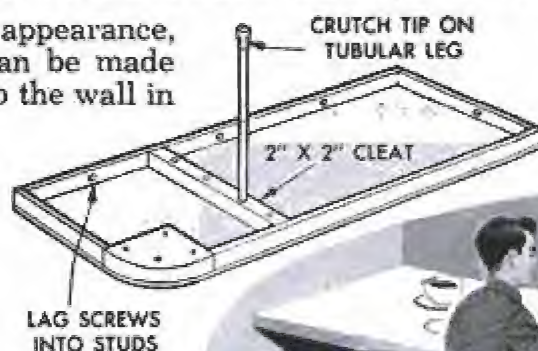
A carrier on top provides ample room for two tires and is located toward the rear so that spares can be removed by standing on the lowered tail gate, Fig. 6. Valves should be turned out and down to permit easy checking of air pressure from the ground. Fabric straps for fastening the carrier to the car top should be replaced with steel straps and bolted clamps to discourage tire theft.

Upon completion of the conversion, a shakedown run was made across some of the most rugged desert terrain in southern California and into the Kofa Mountain region of Arizona. It was possible to move about inside the car and photograph from all sides. Meals were taken completely in the open and usually with the tail gate used as a table. The bunk arrangement is unbeatable with an over-all length of 7 ft., which is longer than most standard beds. Everything for an extended trip is carried inside the station wagon where it is much less of a temptation to thieves and is protected from wind and weather. Our bed and board are on wheels and home is wherever we stop. ★ ★ ★

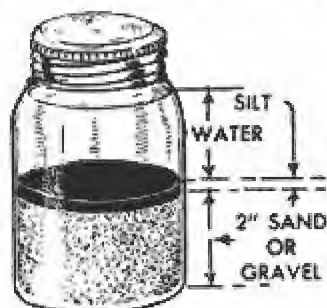


One-Legged Breakfast-Nook Table Bolted to Wall Studs

With its simple modern appearance, this breakfast-nook table can be made and permanently attached to the wall in a very short time. It is screwed to cleats along the side and one end which are in turn fastened to the wall studs with $\frac{1}{4}$ x $2\frac{1}{2}$ -in. lag screws. Before attaching the table to the cleats install the leg made from a length of chrome-plated tubing 1-in. dia. or larger. The upper end should fit snugly in the round hole drilled partially through the cross-brace cleat that is screwed to the underside of the table surface. A rubber crutch tip is fitted to the lower end of the leg to protect the floor covering.



Sand and Gravel for Concrete Checked for Silt Content



For best results, ordinary bank-run sand and gravel should be checked for silt content to determine their suitability for use in making concrete. Too much silt will prevent the cement from bonding properly to the sand and gravel, resulting in weak and porous concrete. To check for silt content, place a sample amount of sand or gravel in a pint fruit jar to a depth of 2 in., add clear water to almost fill the jar. Shake vigorously and allow to stand until the water clears. If there is a layer of silt on top of the sand or stones of more than $\frac{1}{8}$ in. in depth, the material will require washing before using in concrete.

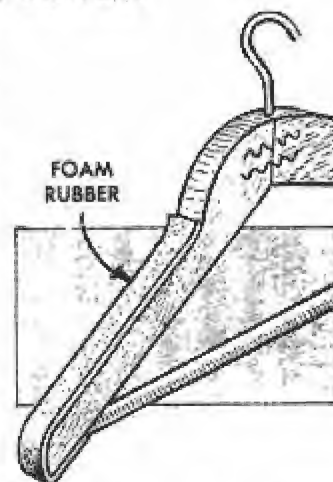
Bright Light Helps in Repainting And Applying of Clear Finishes

Excessive overlapping and "holidays" (poorly covered areas) frequently occur when indirect lighting is used to illuminate a surface being covered with a paint of similar color or a transparent finish. A source of strong, glaring light to accent the wet surface will help to avoid this difficulty and also eliminate unnecessary eyestrain. When working on floors or walls, simply remove the shade from a table lamp and place the lamp just outside the line of vision. One or two strategically placed floor lamps will aid in repainting ceilings and the tops of high walls.

Henry M. Gerome, Hopwood, Pa.

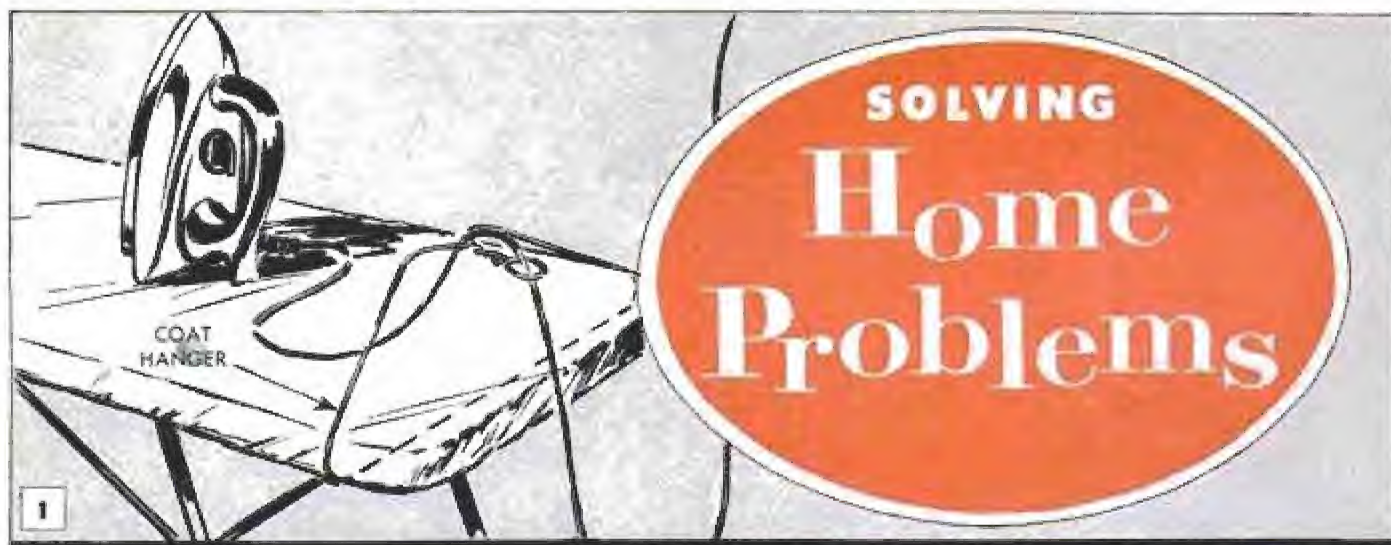
Foam Rubber on Wooden Hanger Provides Nonslip Surface

Foam-rubber strips glued or tacked to the supporting surfaces of wooden clothes hangers permit a better grip by light articles of clothing such as shirts or blouses. The rubber used may be of the type mounted on cloth backing and sold by the yard for use inside skirt waistbands



to anchor blouse "tails." The tape backing should be removed from the material before applying it to the hanger with rubber cement. A good substitute is foam-rubber weather stripping with adhesive backing.





1. WIRE COAT HANGER with hook bent to form an eye serves as a cord holder for electric iron. It supports cord at the right height and prevents kinking. Hanger is wedged over end of ironing board to make it stand upright and eye is bent downward as shown

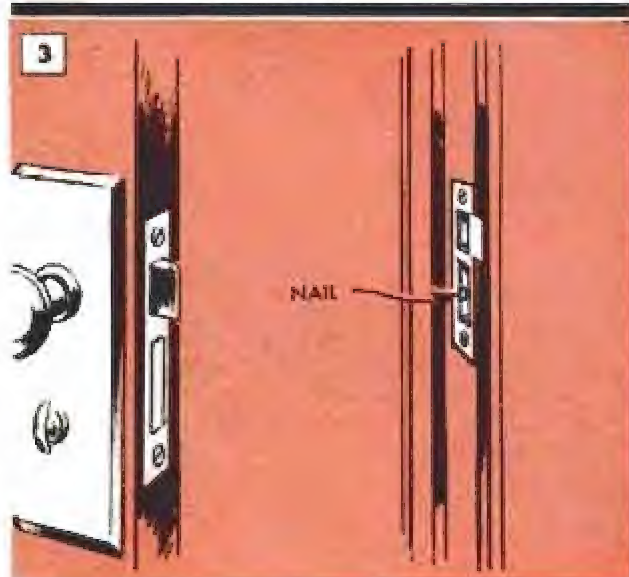
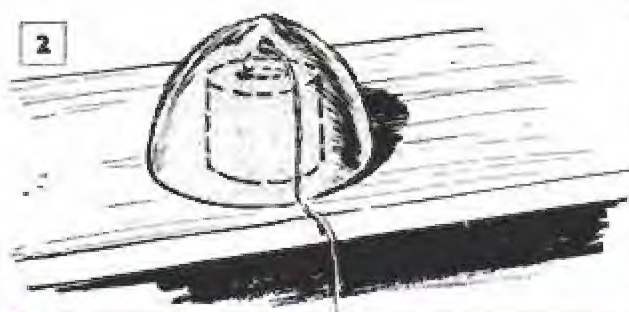
2. HANDY TWINE DISPENSER is made from the half of a coconut shell containing the "eyes." Drill hole through one eye, pass twine through it. Invert on shelf. Weight of coconut is sufficient to permit twine to be pulled through hole without upsetting the shell

3. NAIL OR TACK driven into lock-plate mortise will prevent youngsters from locking themselves in play-room or bathroom. Nailhead must be flush with plate. Screw may be used instead of a nail, if you wish, which will allow it to be turned in the right amount

4. SOAP rubbed on bathroom mirror and immediately wiped off with a soft cloth will prevent fogging of surface. Coat surface with uniform film before wiping. When coated in this manner, steam from shower or wash bowl will not cloud the glass in usual manner

5. HAIRPIN bent and taped to an easel support provides necessary tension to hold easel securely upright. Degree of bend determines angle at which easel stands. It may be found necessary to add two pins to provide adequate support in the case of a large frame

6. BAR OF SOAP inserted in slot cut in artificial sponge dispenses soapsuds in just the right amount for cleansing washable wallpaper or delicate fabrics. Form a pocket in the end of the sponge by carefully cutting through the center with a sharp paring knife



5



6



7. REMINDERS TO CALL are sure to be noticed promptly if the notation is clipped to the phone cord with a spring clothespin rather than written on a pad where it may be overlooked or misplaced. Works equally well with wall phone or desk phone for messages that are important. Plastic clothespin is best

8. RUBBER HOSE cut into 4 or 6-in. lengths makes just the right kind of wedge for holding plastic slip covers in place. Forced down between cushions and arms of upholstered chairs and sofas as in the detail, wedges hold covers taut, preventing wrinkling and tearing and also greatly improving their appearance

9. SALT SOLUTION of mild to medium strength generally will remove grease stains from fabrics without leaving a trace. Just spread fabric on a flat surface and sponge solution liberally onto the stained area. Then rub lightly with a soft, dry cloth. Repeat the procedure if any traces of grease remain

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Clamps Hold Thin Wooden Members While Edge-Sanding Them

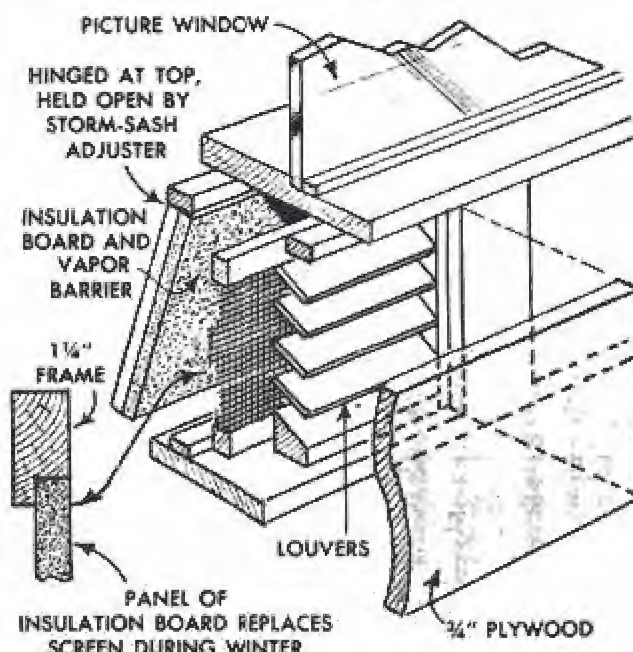
When edge-sanding thin wooden members that are difficult to hold, you can do a better job if the work is held against a block with a C-clamp (left). For extra-thin or long members, fasten a clamp on two ends and both hands will be free.

Detergent Cleans Asbestos Siding

Asbestos-siding shingles look as good as new after cleaning with a good detergent powder. Soak them with clear water and then scrub with a strong, hot solution, using a half cupful of detergent in each bucket of water. Be sure to work up from the bottom and rinse thoroughly to avoid streaking. Stubborn spots remaining may be removed with scouring powder.

Winter Protection for Vents Under Picture Windows

In localities where cold winters are experienced, a louvered vent under a stationary picture window must be provided with adequate insulation to keep out cold, and a vapor barrier to prevent condensation on the cover fitted over the inside of the vent. During cold weather a panel of exterior-type plywood should be placed on the outside over the vent and the insect screen on the inside should be replaced with a panel of rigid insulation board. A vapor barrier should be applied to the room side of the insulation board. The inside panel is hinged at the top and fitted with a storm-sash adjuster at the bottom to permit opening it for ventilation on mild days.



Preparing Scratches on Automobile Body for Repainting



When scratched and chipped spots on an automobile finish must be cleaned of rust before repainting, use a small wire wheel chucked in a hand grinder. The wire wheel will remove rust and paint quickly and can reach areas difficult to clean with sandpaper. After wire-brushing, wash the area with gasoline or solvent, then apply a coat of primer.

Harrison Neustadt, New York City.

Abrasive Soap Cleans Fireplace

An abrasive soap in paste form such as mechanic's hand soap will shorten the time it takes to clean a brick fireplace. Used with hot water and applied with a stiff-bristle brush it will remove grime and smoke deposits. Rinse with clear water.

Blanche Campbell, Los Angeles, Calif.



What to do about ROOF LEAKS

Simple and effective ways to stop leaks before they can cause extensive damage and costly repairs.

By E. R. Haan

NO PART OF A HOUSE takes a more severe beating from wind and rain than the roof, since it is exposed to all kinds of weather. Because it must protect structure, furnishings and occupants from direct contact with the elements, a roof deserves the best of care. When you notice water stains on walls and ceilings, check for roof leaks. The latter may be the cause if the stained spots become damp during or immediately after a rainstorm, or when snow is melting. Repeated leakage may rot wood, cause paint to peel and ruin plaster.

Pinpointing Roof Leaks

Some roof leaks are easy to find. Others take a long, devious route that is concealed for the most part. On a sunny day you may be able to detect small holes in the roof from inside a dark attic. When a hole is located from the inside, stick a fine wire through it so the wire can be seen from the outside.

The sources of many leaks are the flashed

Above, "metal shingles" are pushed under wooden shingles to stop leakage through valley flashing. Below, leak in metal deck temporarily repaired by squeezing calking compound under loosened solder



Tuck-point chimney brickwork when necessary so that rain cannot seep through mortar. Be sure counter-flashing has a watertight seal in mortar joints





joints of a roof valley as in Fig. 1, chimneys, vent pipes, or where a roof joins a wall. Mortar joints on a chimney require periodic tuck-pointing, Fig. 3. Gutter hangers should be nailed under shingles directly to the roof sheathing as shown in Fig. 4. If a leak is detected during the winter months fill holes or cracks with calking compound or roofing cement for a temporary repair, then make permanent repairs in warm weather.

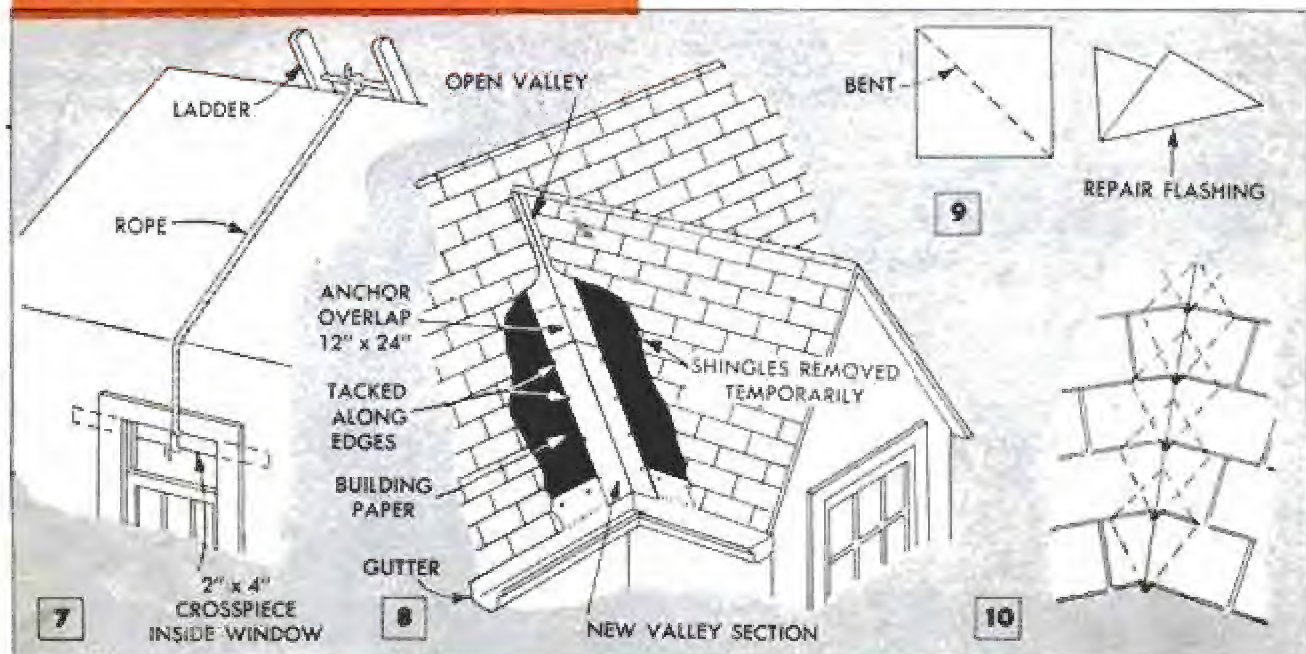
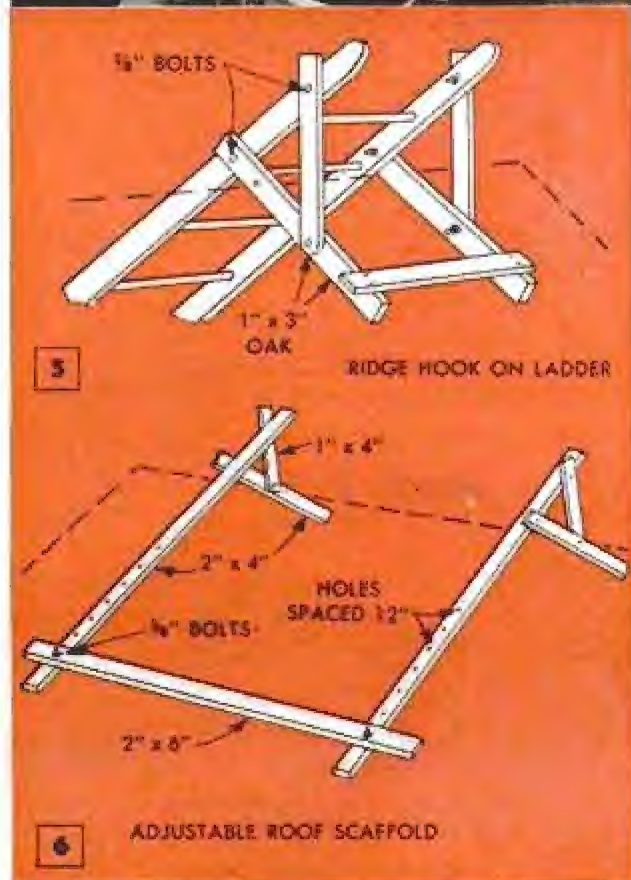
Safety on a Roof

Don't court an accident by taking chances on a wet, high or steep roof. Repairs can be made on a steep roof with relative safety from a ladder provided with a ridge hook, Fig. 5. A roof scaffold can be arranged similarly as in Fig. 6. For additional safety anchor the ladder with a length of strong rope tied to a crosspiece placed inside a window, Fig. 7.

Flashing Repair

When it is necessary to repair leaky flashing, first cover the affected area with flashing compound. If this does not stop the leak, replace bad sections with copper or aluminum flashing. When only the lower part of a valley flashing is replaced some shingles must be removed temporarily, the defective portion cut off and a longer piece of equal width installed as in Fig. 8. Sheet-metal flashing for valleys should be 18 in. wide or more for a closed valley, 24 in. or more for an open valley, depending to some extent on the roof pitch. When installing flashing, bend it longitudinally to conform to the pitch of the roof. Nail the flashing at the side edges only.

If roll roofing is used for flashing it



should consist of two layers. Unsurfaced asphalt felt not less than 18 in. wide is cemented to the sheathing for the inner layer and a mineral-coated asphalt-felt strip 36 in. wide is cemented to the first layer for the outer one.

When a leak develops in flashing under wooden shingles a temporary repair can be made by pushing sheet-metal squares, bent diagonally, under the shingles, Fig. 9. Begin at the bottom and work upward. Each piece should extend about 3 in. above the butts of the next higher course of shingles.

Chimney and Other Flashing

Chimney flashing, which consists of two layers of sheet metal—the base flashing and the counter flashing, Fig. 12—often is the source of leaks. Counterflashing is embedded in mortar joints of the brickwork. The latter is kept in good condition by tuck-pointing when needed. Single lengths of flashing are used to span the chimney width when the joint between chimney and roof is horizontal. Small “metal shingles” are used where the roof slopes along the chimney. A saddle, Fig. 13, helps to shed water from melting snow.

A horizontal joint between a roof and wall covered with siding, shingles or stucco is flashed with sheet metal installed under the wall covering about 4 in., and over the adjoining roof about the same distance. When a roof joins a brick wall, follow the same method of flashing as is used on a chimney.

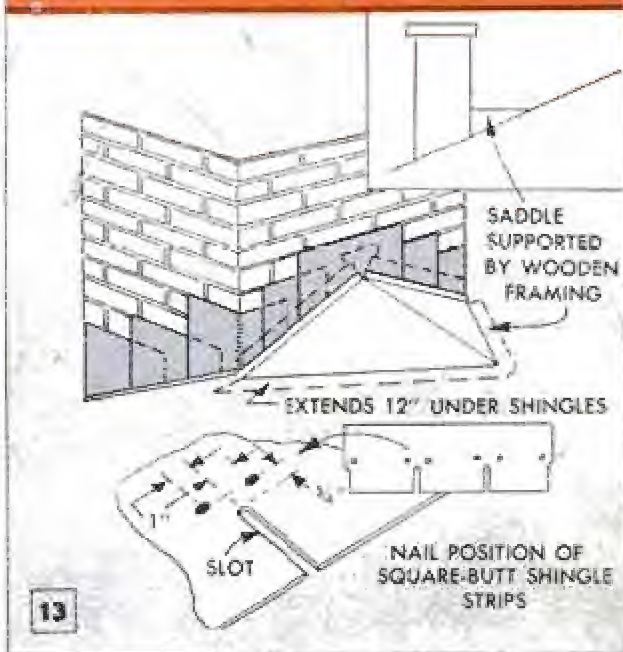
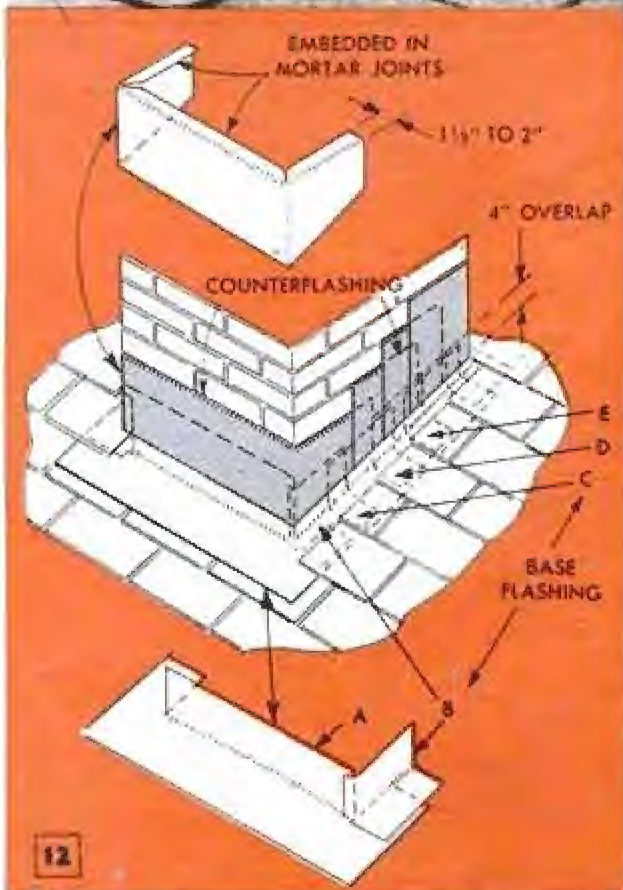
Asphalt Shingles

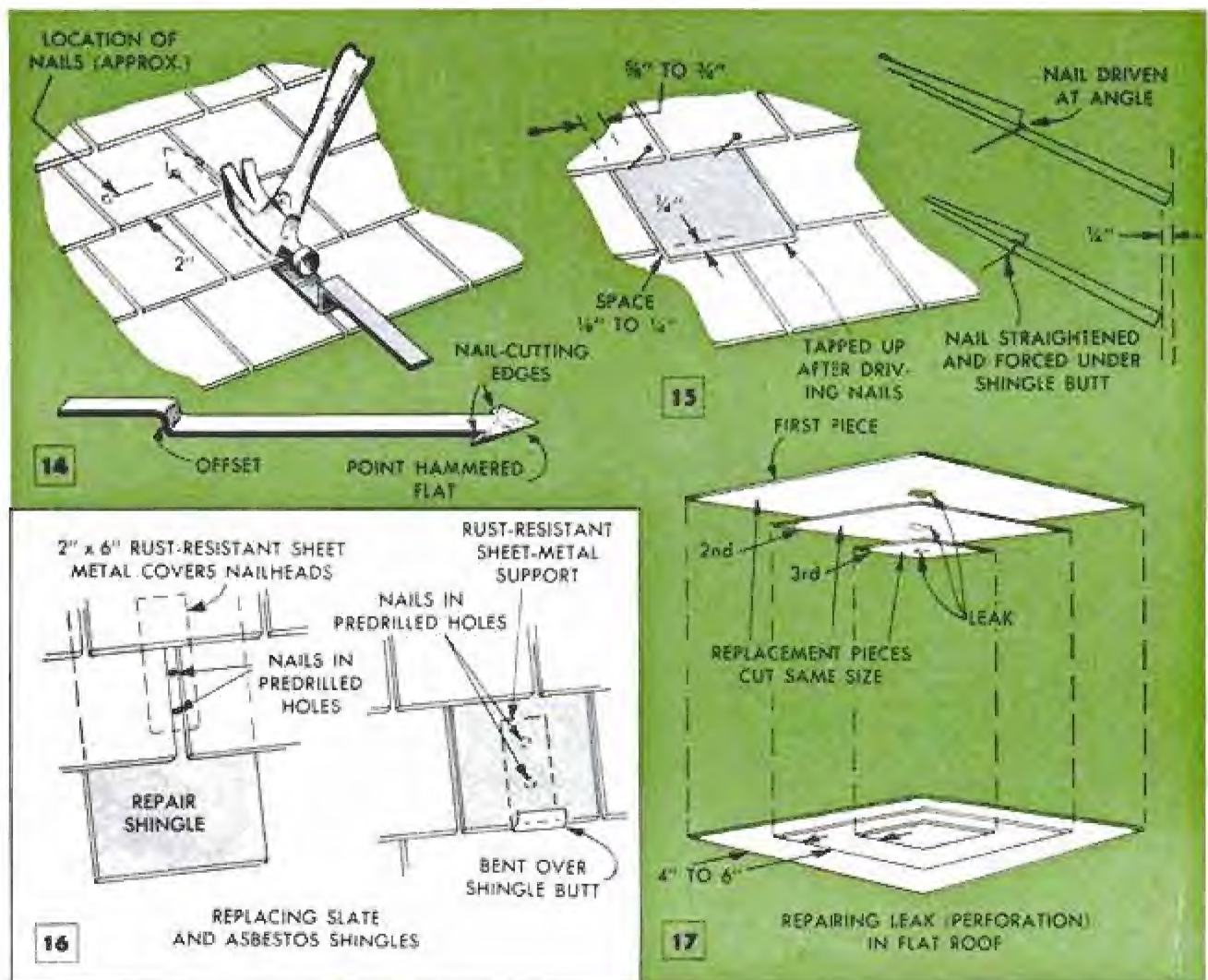
The most common roof-covering material is asphalt shingles in strip form. Sometimes shingles are damaged by wind, which raises and breaks them off, causing leaks. It is best to replace shingles damaged in this way with new ones. When prying up the nails, a strip of wood or metal is used as a fulcrum under the prying tool, Fig. 11. Install the new shingles at the bottom of the damaged area first, using rust-resistant nails, Fig. 13.

When a leak in an asphalt-shingle roof is caused by water driven under the shingles, the trouble can be corrected by applying roofing cement under the lower parts of the shingles.

Wooden Shingles

Leaks can occur in a roof covered with wooden shingles when the shingles dry out, curl and crack. Curling can be prevented by applying shingle oil or paint periodically. When a wooden shingle is cracked in line with the joining edges of shingles just above and below it, a leak is likely to result. If the shingle is not loose, a piece of





sheet metal can be pushed under the crack to stop the leak.

When a defective shingle must be replaced, the nails holding it should be severed first with a nail cutter as shown in Fig. 14. After the replacement shingle has been driven so that its butt end is $\frac{1}{4}$ in. below adjacent shingles of the same course, drive two shingle nails at an angle just under the butt end of the overlying shingles, Fig. 15. Tap the shingle up in place to bring the nailheads under the overlying shingles.

Slate, Asbestos, Tile Shingles

This group of shingles will last a lifetime under normal conditions but is susceptible to mechanical breakage. Broken shingles can be replaced in two ways, Fig. 16. The detail at the left shows how nails are driven through holes drilled after the shingle has been pushed into position. A piece of sheet metal is then pushed over the nailheads. The detail at the right, Fig. 16, shows a strip of metal fastened under the replacement shingle and bent up against the butt end of the shingle to anchor it.

When asbestos or slate roofs fail because the nails have rusted, the entire roof cov-

ering should be removed and replaced. All unbroken shingles can be reused. A roof tile that is broken should be replaced with a new tile set in roofing cement.

Built-up Asphalt and Gravel Roofing

Although very durable, initial failures of built-up asphalt and gravel roofing occur at flashings. A leak can be repaired by removing and replacing only two or three layers of the roofing, one at a time in progressively smaller squares as in Fig. 17. Each of the new pieces is cemented with hot tar, followed with a layer of gravel and a coat of topping cement.

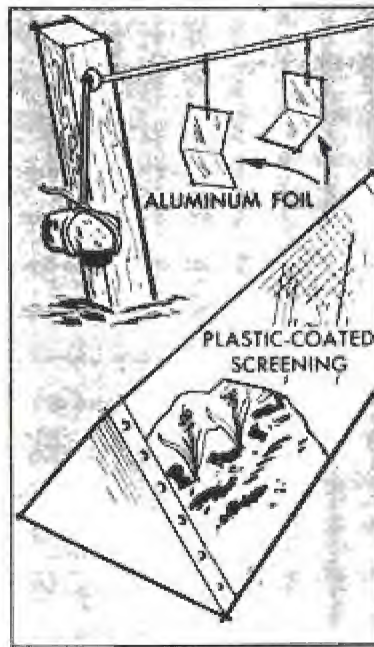
Metal Roofs

Galvanized-iron roofs require periodic painting to prevent excessive rusting. Leaks usually develop at rust spots, loosened seams, or where the metal is pierced by nails or screws. When galvanized iron is too rusty for soldering, it can be repaired by coating the affected area with roofing cement. Then press a piece of muslin on the cement and brush more cement over it. Another similar method of patching which is more permanent is to use glass-fiber cloth saturated with a special resin, such as used for auto-body repairs. ★ ★ ★

Aluminum-Foil "Scarecrows" Protect Plantings

Strips of aluminum foil, creased in the middle and suspended from a cord, will discourage birds from pulling up young plants. The cord is run through screw eyes on posts at the ends of the rows, and weighted to keep it taut. On long seedbeds, the end posts should be slanted out away from each other to give added support to the cord.

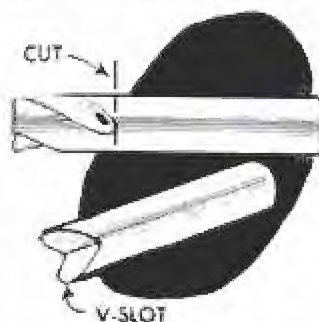
Tender plants which are susceptible to hot sun or cold air can be protected with a cover of translucent-plastic laminated screening, which also is effective in warding off attacks by birds, insects and small animals. Triangular-shaped wooden ends are held erect and apart by joining similar corners of the triangles with lengths of stiff, heavy wire. The plastic screening then is wrapped over the top wire, stapled to the bottom



two and tacked to the end supports. A stick driven into the ground and nailed against one end will aid in keeping the assembly steady. In windy areas it may be necessary to locate stakes along the lower wire to keep it in place.

Punch Made From Drill Shank

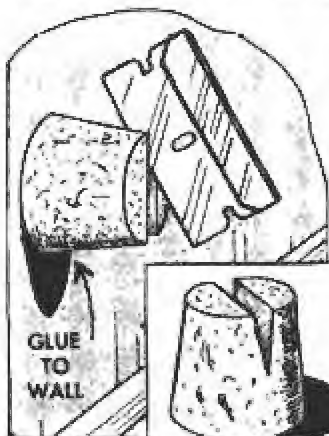
A punch for use on light sheet metal can be made from the shank of a discarded or broken drill of the diameter needed for a particular job. After cutting off the shank, grind a V-slot in the severed end of the shank as indicated. A sharp blow with a hammer on the blunt end of the punch will cut a clean, neat hole in the sheet metal.



Henry Josephs, Gardenville, Pa.

Notched Cork Stores Razor Blade

To keep a single-edge razor blade in a safe place in your workshop, cut a deep V-notch in a large cork and glue it to a wall or other appropriate surface near the workbench. The blade is always at hand to cut patterns, trim photos and for other jobs.



Sheet-Metal Jig Locates Nails Along Edge of Workpiece

This simple jig will enable you to do an accurate job of locating nails along the edge of a piece of work. The jig is simply a strip of tin-can metal bent at right angles and with a V-notch cut in one leg to position the nail the right distance from the edge. In use, the jig is held against the edge of the work and the nail is started in the bottom of the V-notch.





Note how drawing of horse above is simplified as compared to the photo below



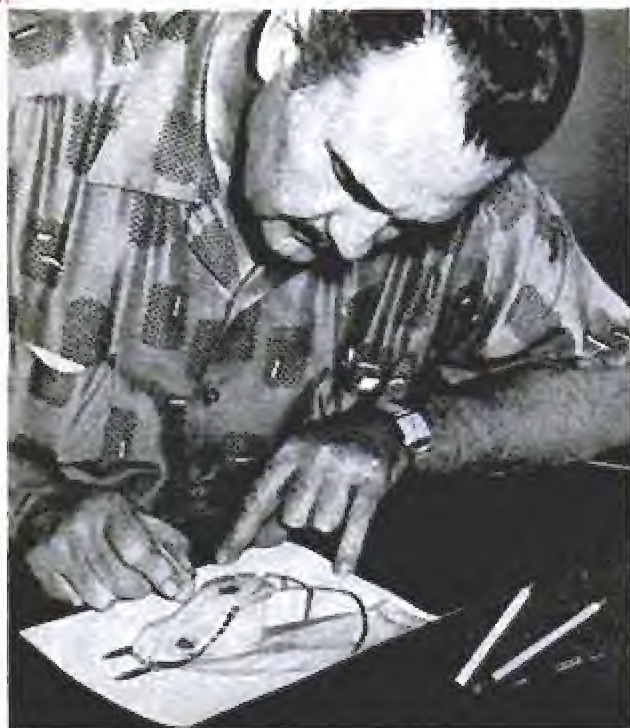
Start at the top of the print and work downward, shading in all the light areas with a pencil. Do not draw in the background

Photo of the head of a horse is excellent subject; has simple lines and shading

WTM 58
PHOTO SKETCHES

PHOTO SKETCHING

By Shep Shepherd



HAVE YOU EVER WISHED to sketch a figure, object or scene, but lacked artistic ability? If you have a camera and an enlarger, you can make sketches or paintings of anything that can be photographed. Photo sketching permits substituting time and patience for natural ability.

You will need these items: 3 pencils (soft, medium and hard), an ordinary pencil eraser, drawing paper and a photo negative. The reverse side of photo-enlarging paper can be used for drawing paper. Because you will later need a photoprint for checking the sketch, first make an enlargement from the negative in the usual manner. Make it the same size that you intend to make the sketch. Leave the negative in the enlarger, place a sheet of drawing

If pencil shading goes beyond lines of figure or into white areas, make corrections with an eraser



First step in making painting by using photo-sketching technique is to sketch photo as above. Include only outlines of prominent objects and indicate shading

Select photo that can be sketched with simple lines. In photo below, mountains, hills and stream are single curves, while rocks in stream are irregular spheres



Using original photo as guide, artist first makes rough sketch, as above, then applies oil paints to produce picture below



paper on the easel and open the enlarger lens to its fullest aperture to obtain a brilliant image on the paper. If the enlarger does not have heat-resistant glass condensers, open the head to prevent overheating.

At this point you have a negative image projected on the drawing paper. This means that all the areas that are black in the finished positive print will be white in the negative image, and those that will be white on the finished print will be black. Start at the top and work downward, shading all the light areas until they are as dark as the darkest part of the image. On those areas that are completely white, use a soft pencil. Use a medium soft on the light-gray areas and hard pencil on the dark-gray areas. Do not sketch over areas that are black. Continue until the entire picture is one shade of black or dark gray. Occasionally turn on the room lights and inspect the work as you progress.

Draw a pencil line around the outer edges of the image to outline it, since the background will not be copied. Also, draw lines in any important areas within the image itself, such as eyes, hairlines, collars, etc. It is advisable to outline the image before any sketching is done, then if the

easel accidentally is moved, the outline will permit quickly realigning the sketch with the image. Although the work can be done completely under the enlarger, it is best to sketch in only the important areas, plus the outline and important inner lines. Then the partially finished sketch is placed beside the print of the original on a desk or table, where the work can be done more comfortably under a bright light. Study the photograph and sketch in shaded areas in the drawing where they are needed. You also can insert new lines or omit lines that are in the original picture, if by doing so the appearance of the drawing is improved or simplified. Note that in the sketch of the palomino horse several changes were made in the reins and bridle to omit tedious detail. Omission of the detail does not change the over-all appearance of the sketch, and actually adds to its "freehand" look.

When shading areas near the edge of a figure, do not worry about running over the outline. The sharp edge of an eraser can be used to correct this situation. In fact, it sometimes is better to let the pencil sweep over the edge of the outline so that a sharp edge does not result from the pencil being lifted abruptly or turned along the



Photo sketch of beribboned puppy demonstrates again how the drawing should be simplified as compared to photo. For purposes of illustration, pencil mark around outline of figure is exaggerated

edge of the outline. For the same reason, if the pencil lines run into areas that will be white in the finished sketch, erase them after the drawing is removed from the enlarger easel.

Subjects with simple lines and areas of smooth gradation are best for photo sketching. For example, a lion would make a better subject than a tiger, since the latter's stripes would entail too much critical work. Although the finished sketch may not have a professional appearance, it will have a unique quality that is not produced by any other method. One useful application of the photo-sketching technique is to make an outline or rough sketch of a picture that is to be painted in oils or water colors. The paint will, of course, cover the faint pencil lines of the sketch made from the photo.

Subject such as sea gull is ideal for photo sketching. Bird has simple outline, a minimum number of details and only slight gradation of color



A practical use for the technique is in determining the appearance of a building when changes are to be made that will change its exterior size and shape. Make a sketch of the building and draw in the suggested changes. The appearance can be judged at a glance.

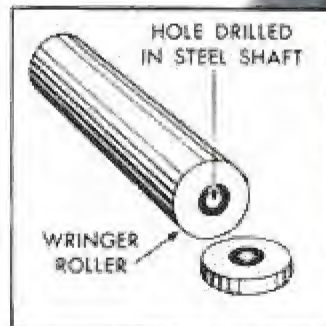
However, the greatest value of photo sketching comes from its sheer entertainment value in creating unusual pencil drawings of pets, children, friends and other familiar subjects and later displaying them. After doing a number of drawings with the photo-sketching technique you will gain skill and can start improvising. An example is shown in the treatment of a landscape photograph on page 187. In the original photo, a fisherman was standing beside a small, meandering stream. The finished painting, which was done with oils, omitted the man, enlarged the stream and changed the character of the mountains in the background. There is little resemblance in the finished painting to the original photo. ★ ★ ★



Wheels for Toys Cut From Wringer Roll

Next time you make a mobile toy why not equip it with rubber-tired wheels cut from a discarded clothes-wringer roller? First drill a hole in the center of the roller shaft to facilitate mounting. Then slice off the wheels in any desired width using a metal-cutting saw blade. The edges on the circumference of the wheels can be removed with coarse-grit sandpaper to give them a contour similar to auto tires. If a tread pattern is desired, "brand" it on with the cutting edge of a hot hacksaw blade. Attach the wheels to the toys with wood screws.

Earl R. Phelan, San Jose, Calif.



Hole Cutter "Turns" Plugs

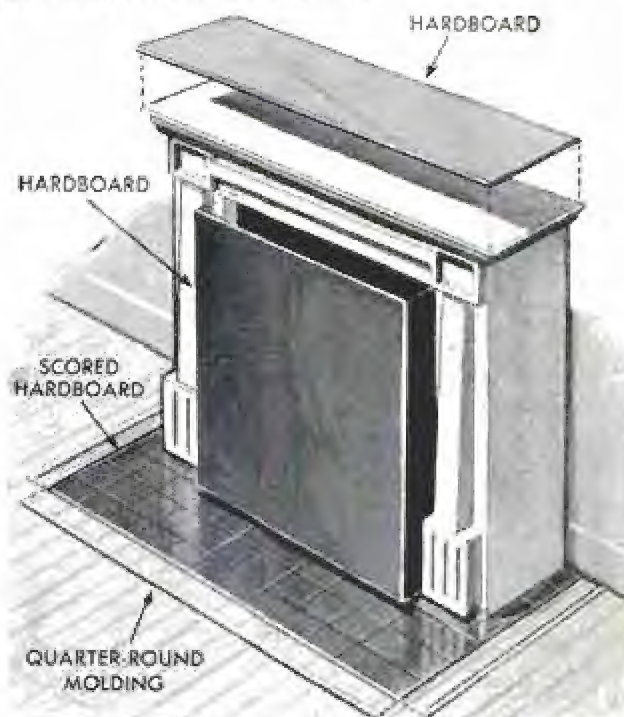
When you need round wooden plugs to fit screw holes, or other openings, make them with an adjustable hole-cutting tool. Remove the pilot bit, and reverse the blade so that it makes a perpendicular cut on the inside. Use scrap stock matching the piece to be plugged and clamp it firmly to the drill-press table. The blade on the hole-cutting tool should have a sharp edge to prevent chipping or gouging the top of a plug, especially when soft or coarse-grained wood is used for this purpose. After a plug is cut it can be removed by prying with a narrow chisel or similar blade-type tool, then cut to the required length.

Ken Murray, Colon, Mich.

Salvaged Fireplace and Mantel Lend Atmosphere to Home

Installing a false fireplace front and mantel in your home adds an atmosphere of warmth, whether you live in a house or apartment. The basic unit might be salvaged from an abandoned farmhouse, or procured from a homeowner who is remodeling his house. Start by laying the hearth floor, using a panel of hardboard which has been scored into 4-in. squares. If the adjacent floor is exposed, a molding of 1/4-in. quarter-round is nailed on around the edge of the panel. Setting up the unit, it may extend from the wall, as shown in the illustration, or be cut shallow to give the appearance of being recessed. A panel of hardboard is then fastened inside the fireplace to conceal the wallpaper behind it. If the mantel top is warped or cracked, cover it with a narrow piece of hardboard. Floor panel is given one coat of tile-red deck paint to create a mottled effect and the panel inside the fireplace is painted black.

Masonite Corporation, Chicago.



Finding Correct Height for Setting Plate Bolts Into Concrete



Bolts for attaching the bottom plate of a frame wall to a concrete foundation or floor can be set to the correct height by first nailing the bolts to the ends of scrap pieces of 2 x 4-in. lumber. The nails are driven slightly off-center and then bent around the bolt, as shown in the detail. While the concrete is still wet, place the blocks flush with the form edge forcing the bolts down head first into the concrete so that the attached nut rests on top of the block. After the concrete has set, the nuts are unscrewed and the blocks removed. Then the bottom plate is placed alongside the bolts and marked for drilling. After matching holes have been drilled, the plate is slipped over the bolts and fastened down. Not only will use of the blocks keep the bolts at the proper height, but they will also keep them vertical and at the same distance in from the edge of the concrete, which simplifies laying out and drilling holes in the plate.

Herbert E. Fey, New Braunfels, Tex.

Rock Lining Protects Garbage Can

To provide drainage around his underground garbage can and prevent rusting, one homeowner encased the can in gravel and rock. The bottom of an oversize pit was covered with flat pieces of broken concrete sidewalk and a steel liner lowered into the hole. With a corrugated cardboard form, 4 in. greater in diameter, placed around the liner, gravel is poured between the latter and the cardboard. To prevent the cardboard from buckling, the gravel should be poured at the same rate the dirt fill is added outside of it. A gravel cap on the surface completes the installation. The can is lifted out by means of a wire bail.—Larry W. Smith, Portland, Ore.



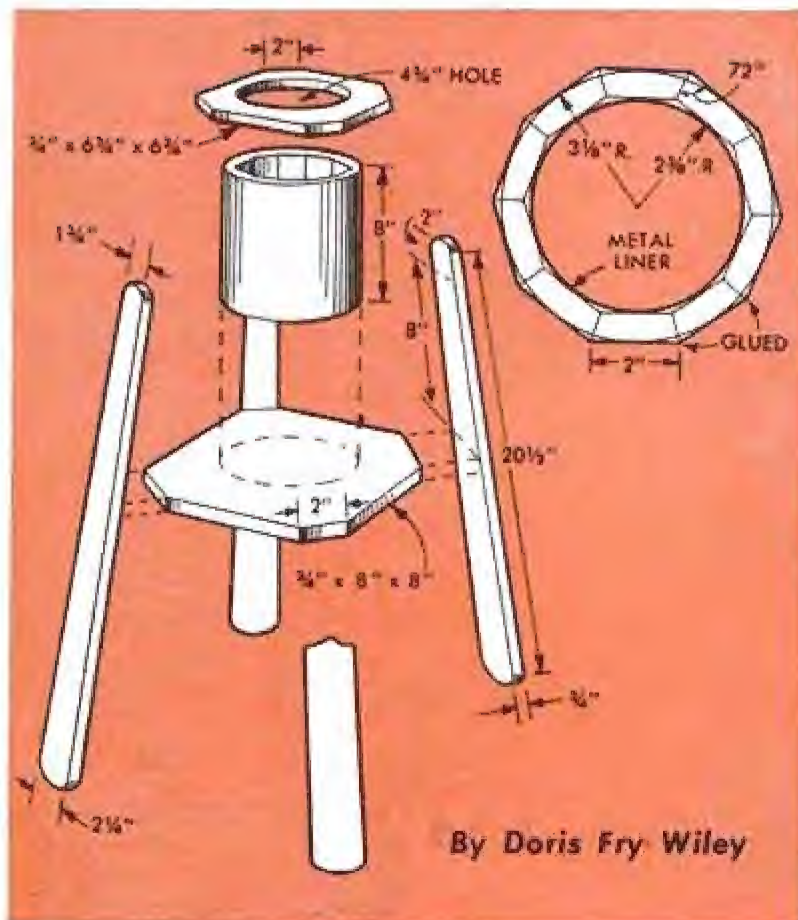
Battery Holder Used in Electrical and Radio Experiments



Hold penlight batteries for electrical and radio experiments in this simple block-and-screw-eye assembly. A pencil line was drawn down the center top of a $4\frac{3}{4} \times 1 \times \frac{1}{2}$ -in. strip of soft wood, and six $\frac{1}{2}$ -in.-dia. screw eyes were twisted an equal distance into the wood in line. The two end eyes should be exactly 4 in. apart, but the other four eyes need only to be placed approximately as shown. Slip the batteries in through the right-hand eye so the positive terminal of the first battery contacts the left-hand eye, which is at right angles. Then turn the right-hand eye until it contacts negative end of the second battery and presses it snug. Leads are connected to the end screw eyes with alligator clips, or by soldering.

Arthur Trauffer, Council Bluffs, Iowa.

Plant Stand



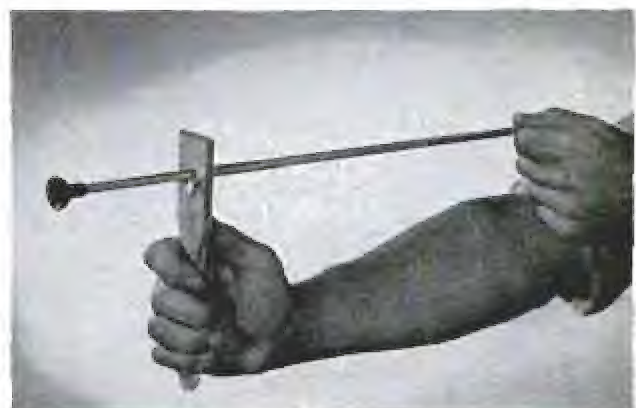
Overcoming the disadvantages of most containers for large plants, which are unattractive and easily upset, this plant stand is modern in design with wide-spaced legs that prevent its being tipped accidentally. Start construction of the stand by cutting 10 strips of 3/4-in. plywood or solid stock 2 x 8 in. Saw the long edges at 72-deg. angles and glue the strips together to form a cylinder as detailed. Cut two disks from 3/4-in. stock 6 1/2 in. in diameter and screw them temporarily to the ends of the cylinder thus formed. After the glue between the strips has dried thoroughly—about 12 hr.—center the cylinder in a lathe and

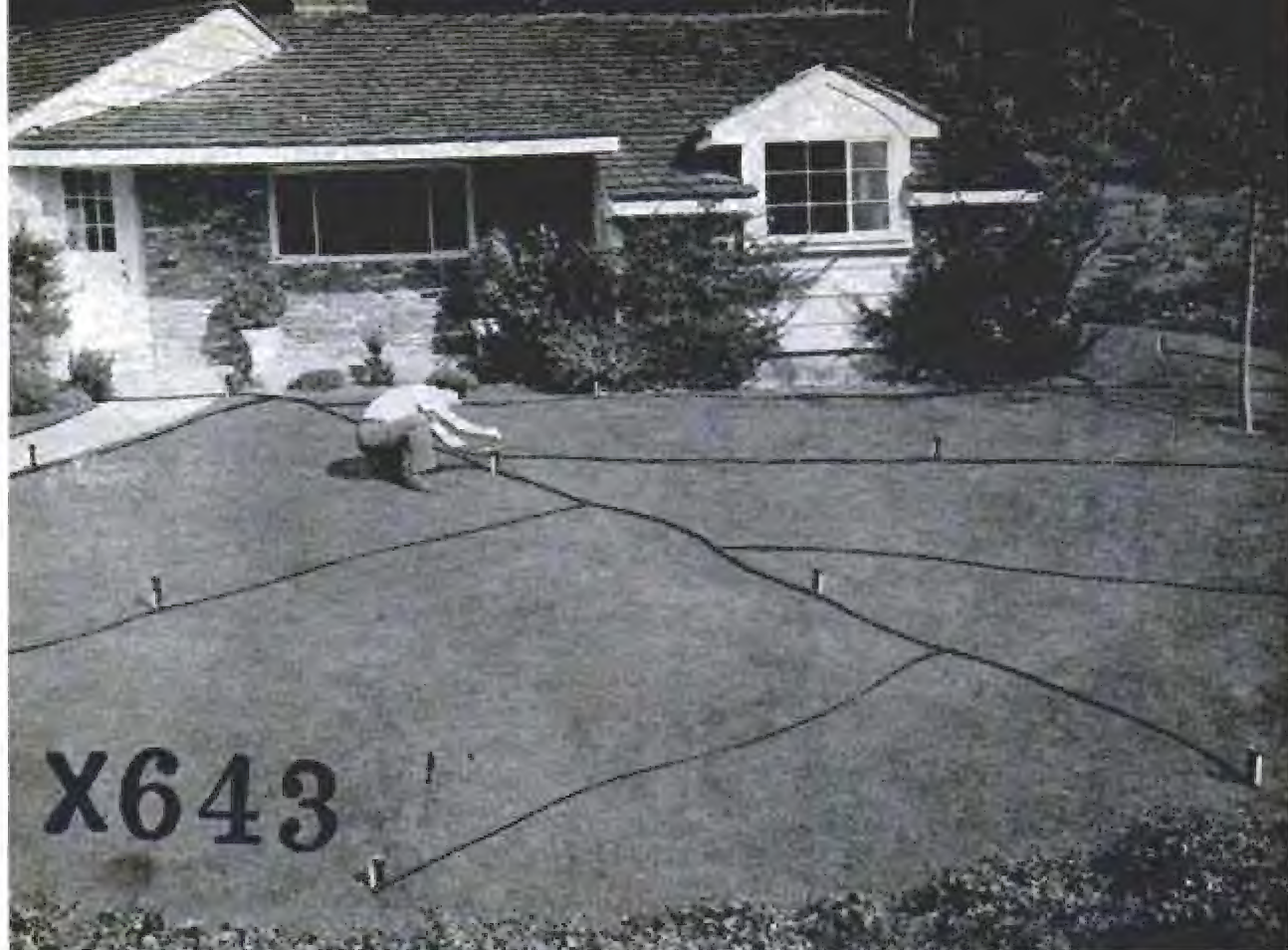
turn it to a diameter of 6 1/4 in. Then remove the disks.

Cut four tapered legs to the dimensions given in the detail, rounding the ends as shown. Mark the shelf locations on the insides of the legs, then cut the two shelves from 3/4-in. stock. The upper shelf, in which a 4 3/4-in. hole is cut, is screwed and glued to the top of the cylinder and to the legs after a metal container is fitted inside the cylinder. The container can be a large food tin or, lacking this, can be cut and soldered from sheet brass. Brass should be used, since it will not rust as will steel. Food tins have a rust-resistant coating.

Simple Rubber-Band Gun

This toy gun utilizes a rubber band to shoot arrows that consist of small suction cups fitted to lengths of 3/16-in. dowels. The paddle-shaped gun is cut from a piece of plywood or tempered hardboard. The arrows are inserted through a 1/4-in. hole drilled centrally and a rubber band is slipped through two saw cuts in the edges of the gun on the center line of the hole. A thumbtack on the front side keeps the band from obstructing the hole.



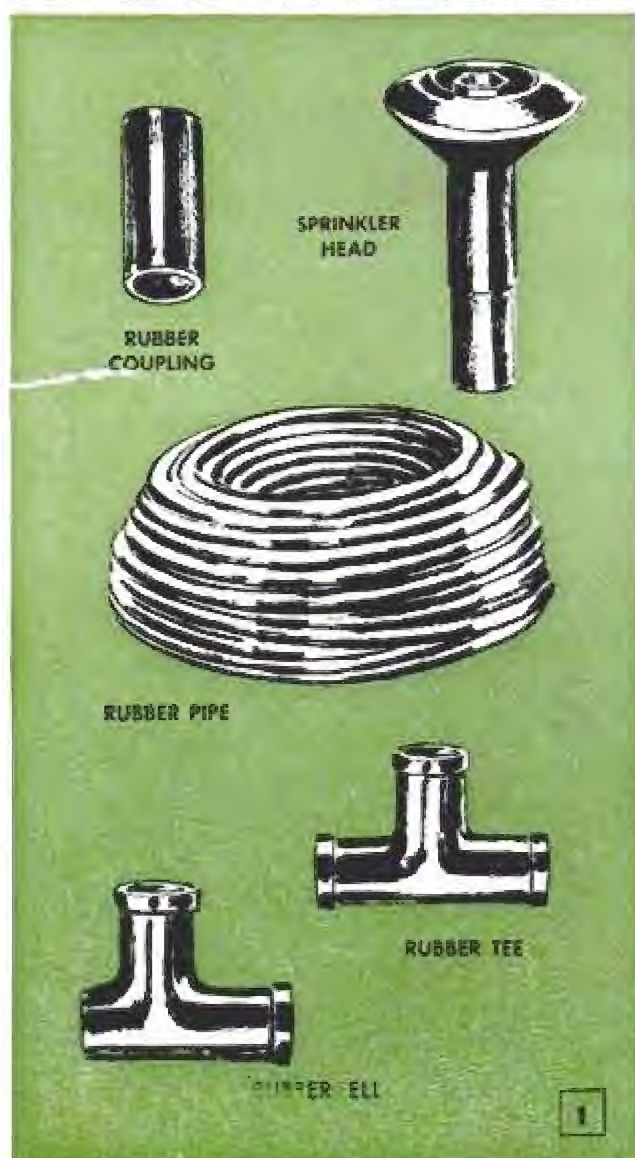


Put Your

WHAT SOUNDS like a homeowner's dream is a practical, inexpensive underground sprinkling system that can be installed by the homeowner himself over a week end. The system is not damaged by alternate freezing and thawing, and consists of flexible rubber pipe, fittings and rubber sprinkler heads that have brass nozzles. Four types of nozzles are available, Fig. 2, providing spray patterns from a quarter to a full circle.

The first step in installing the system is to make a scale drawing of your property and lay out the system as in Fig. 3. Sprinkler heads spray water in a 7-ft. rad., but should be located only 10 ft. apart to assure an overlap in the spray pattern. A typical plan is shown in Fig. 3. After the plan has been drawn, make a table like Form 1 to determine the volume of water required for your particular system. Normally the volume of water available is insufficient to operate all the sprinkler heads together so the system must be divided into circuits which are controlled by separate valves, Fig. 7.

A quick method of determining the volume of water available at your water meter is to open four or more faucets in the house and count the number of times the cu.-ft. dial on the water meter rotates in 1 min.





Garden Hose Underground

Multiply the number by 7.5 to determine the g.p.m. In some instances, a water meter will read directly in g.p.m. If you do not have a water meter, an alternate method of determining the volume of water available is to use a pressure gauge. Borrow one from your plumber or hardware dealer, fit it into the water line and use the table in Form 2 for converting water pressure into the number of control valves needed for your particular system.

If a $\frac{3}{4}$ -in., or larger, dia. pipe leads to an outside faucet, it may be possible to connect control valves directly to this line. However, if the pipe is small or is rusted inside, it is best to install a separate supply line of $\frac{3}{4}$ or 1-in. pipe directly to the valves from the meter. The number of control valves required is figured by dividing the volume of water your system requires by the volume of water available. Draw these control valves on your plan, making sure they are in a location convenient for connecting to the supply line and accessible for operation, as well as clear of sprinklers that would wet anyone operating the valves.

If your particular plan results in a circuit that has a line pressure of more than 60 p.s.i., it will be necessary to install a pressure regulator between the meter and

the control valves or, when no meter is present, on the pressure side of the control valves. An excess amount of water pressure causes the sprinkler heads to discharge water in a fine spray instead of small droplets. The spray is difficult to control and evaporation is much greater. It is possible, in some instances, to control the pressure to the spray heads by partially closing the control valves. However, this may result in rapid wear of the valve seat and face.

Draw lines on your plan from each control valve so that it connects the correct number of sprinkler heads. After the pipelines have been laid out, recheck the water-volume requirements to make sure that each control valve has to deliver about the same amount of water.

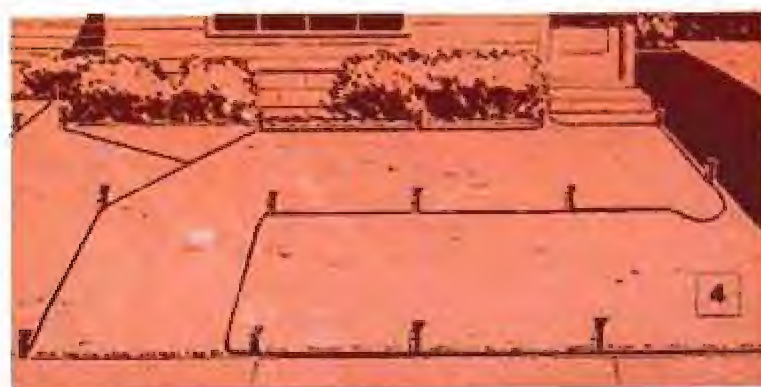
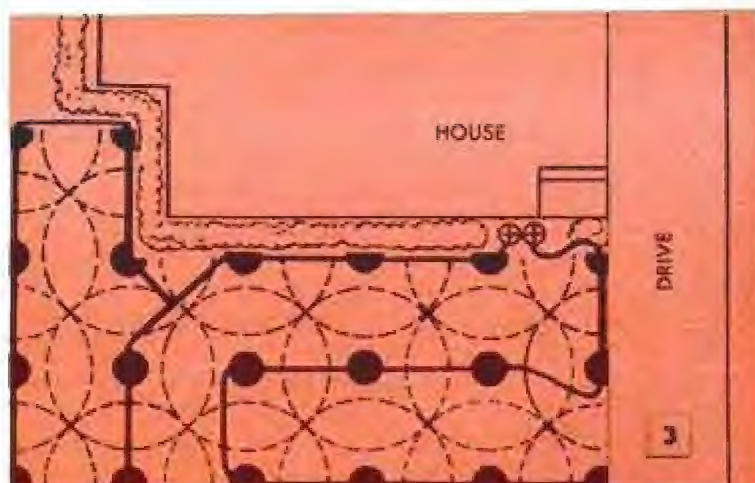
With the system now laid out to scale, you can figure the number of feet of pipe, the number of sprinklers and other fittings needed. To begin the actual installation, set up the control valves as in Fig. 7, using galvanized-steel pipe and fittings. Note that the connections between the steel and rubber pipes must be underground. Also, some provision must be made for draining the valve system during freezing weather. In Fig. 7, a petcock has been installed at the low point of the system. The



full-circle head ● ¾-circle head ◐ ½-circle head ◑ ¼-circle head ◒ control valve ⊕

FORM 1 — TO DETERMINE VOLUME OF WATER REQUIRED

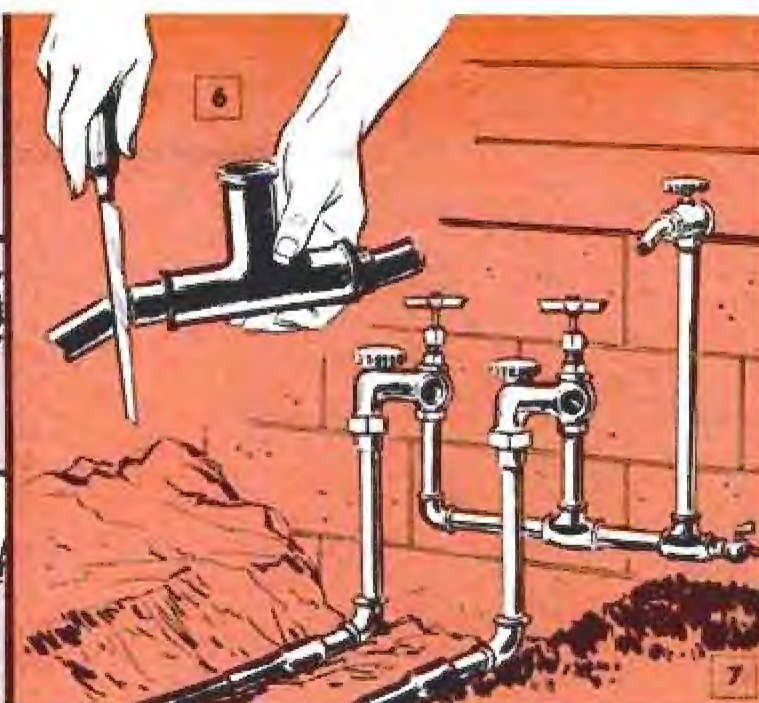
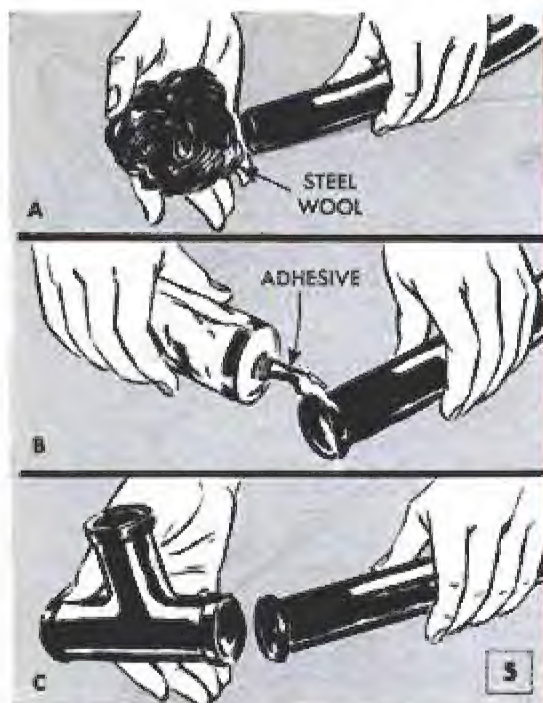
Type of Heads	Number of Heads Needed	Gallons Per Minute Required by Each Type of Head	Total Gallons Per Minute Needed
¼ circle		approx. ½	
½ circle		approx. 1	
¾ circle		approx. 2	
full circle		approx. 2	
Gallons per minute required by system			



control valves should be the anti-siphon type which in many communities are required by law.

The next step in the installation is to stake out the locations of all the sprinkler heads, Fig. 2, according to your plan. Wire a sprinkler head to each stake, as in the detail in Fig. 2. Now, use a rubber coupling to connect the rubber pipe to the steel pipe at the control-valve connection. Clean the end of the steel pipe back about 2½ in. with steel wool or sandpaper, apply a ring of adhesive around the end and slip on the rubber coupling, forcing it over the pipe for the full 2½ in.

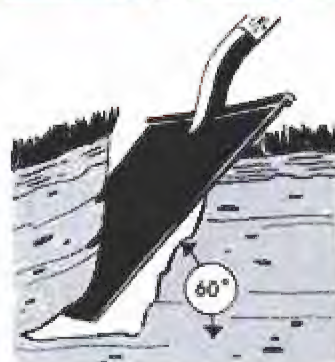
It may be necessary to warm the coupling in hot water for about 15 min. so that it will slip over the steel pipe more readily. Next, rough up the end of the rubber pipe, apply a ring of adhesive and force the pipe into the coupling until it contacts the end of the steel pipe. Unroll the rubber pipe to the first sprinkler head, cut off the pipe and connect it to the first tee as indicated in details A, B and C in Fig. 5. Repeat this operation on the opposite side of the tee and fit the sprinkler-head-and-riser combination into the tee, making sure the nozzle in the head is facing in the proper direction. Do not cement the sprinklers to the tees as yet. In some instances it may be desirable to run a single line of smaller-dia. pipe to locate a sprinkler some distance from the main group. To effect a size



reduction in rubber pipe, for example from $\frac{3}{4}$ to $\frac{1}{2}$ in., cement a length of $\frac{3}{4}$ -in. pipe in the $\frac{3}{4}$ -in. fitting and cut it off so that about $\frac{1}{4}$ in. projects. Then insert the $\frac{1}{2}$ -in. pipe inside the projecting $\frac{3}{4}$ -in. pipe. Reduction from 1 in. to $\frac{3}{4}$ in. is done in the same manner.

Continue unrolling the pipe and connecting the sprinklers until the job is complete, Fig. 4. Now, test the system by opening a control valve until the spray from each head is about 15 in. in diameter. Adjust the screw in the middle of each nozzle so all heads have an equal spray radius. Finally, open the control valve all the way and check for complete coverage. Repeat the procedure for each circuit in the system.

To bury the system, turn on the water in the circuit you wish to work on first and let it soak the ground for about 45 min. or until a spade can be inserted in the ground easily to a depth of 4 to 6 in. Start at the control valve and cut the sod on a line extending a couple of feet past the first sprinkler head. Next, push the spade into the ground at a slight angle for about an inch and pry back, Fig. 8. Repeat this until the slit is 5 or 6 in. deep. At the location of the sprinkler head the slit should be vertical. Cut out a circle of sod for the sprinkler head. Start at the control valve again and insert the rubber pipe, using the rounded end of a length of 1 x 8, Fig. 8. At the sprinkler head make sure the head fits flush with the ground. If it cannot be set deeper, cut off a portion of the riser. Now, remove the riser from the tee,



FORM 2 — NUMBER OF CONTROL VALVES NEEDED AT VARIOUS PRESSURES

1 Control Valve Serves: No. full-circle heads (spacing—approx. 10')				1 Control Valve Serves: No. half-circle heads (spacing—approx. 10')			
Line Pressure	$\frac{1}{2}$ " pipe	$\frac{3}{4}$ " pipe	1" pipe	Line Pressure	$\frac{1}{2}$ " pipe	$\frac{3}{4}$ " pipe	1" pipe
30-lb.	4	6	14	30-lb.	7	10	25
40-lb.	5	8	17	40-lb.	9	15	32
50-lb.	6	10	20	50-lb.	11	18	36
60-lb.	7	12	23	60-lb.	13	23	42

wipe dry, rough with sandpaper, apply cement and reinsert in the fitting. Do not cement the last head in the circuit until all the fittings and pipe have been buried. Then remove the last head, turn on the water and allow it to flush all foreign matter out of the system.

Finally, start at the control valve and tamp the sod into place. Repeat the above operations with the other circuits. The directions of the spray head of fractional heads are given a final adjustment by turning the brass nozzles with a wrench. When separate circuits are installed to cover flower beds, make sure they are located so they will not be disturbed when the flowers are cultivated.

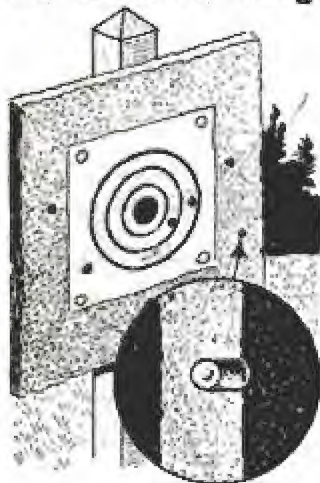
★ ★ ★

Snap-Hook Shortens Anchor Chain On Fishing Boat



Limit drifting of a fishing boat by adjusting length of anchor chain to correspond with the depth of the water, retaining the balance with a snap hook attached to a screw eye driven into the gunwale

Insulation-Board Backstop Safe For Air-Rifle Target Practice



A target backboard constructed of soft insulation board will prevent pellets or shot fired from an air rifle from ricocheting and causing possible damage. The material is firm enough to provide a suitable surface on which to attach paper targets, yet soft enough to retain the missiles

that come in contact with it. For maximum effectiveness and safety, the backboard should be at least 2 ft. square and attached to a sturdy post.

Air Conditioners on Parade

The day is coming when you'll be air conditioning your home—it could be this very summer. A 6-page feature "Year-Round Climate Control" in the June issue brings you up-to-date on what's new in air-conditioning equipment and shows what strides the industry is making in this business of keeping you cool and comfortable 365 days a year



Water-Tank Planting Boxes Mounted on Chain Standard

Unique "planting boxes" on one Montana farm consist of hot-water tanks cut open on one side. Each tank is mounted horizontally on a standard made by welding together the links of a heavy chain. The lower end of the chain is welded to a base made from steel rod. Because the planting boxes are stored away in the winter, the bases are not anchored in the ground.

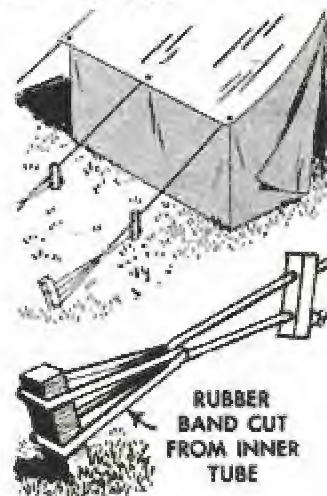
E. V. Reynor, Townsend, Mont.

Removing Fruit-Juice Stains

To remove acid stains, such as result from spilled fruit juices, on leather upholstery, wipe the spot with a cloth dipped in a solution consisting of 1 teaspoonful of baking soda in a glass of water. Then rinse with a soap-and-water solution.

Tent Anchor Ropes Kept Taut With Heavy Rubber Bands

Rubber bands cut from an auto inner tube maintain adequate tension on tent anchor ropes when they are installed as shown. After the tent is erected and initial adjustment made, no further attention is required. When rain or heavy dew causes the canvas to stretch, the band permits automatic adjustment. It also absorbs shocks caused by campers stumbling against the ropes.



Gordon Boose, Windsor, Ont.

POPULAR MECHANICS



TIME

TO BUILD A CLOCKCASE

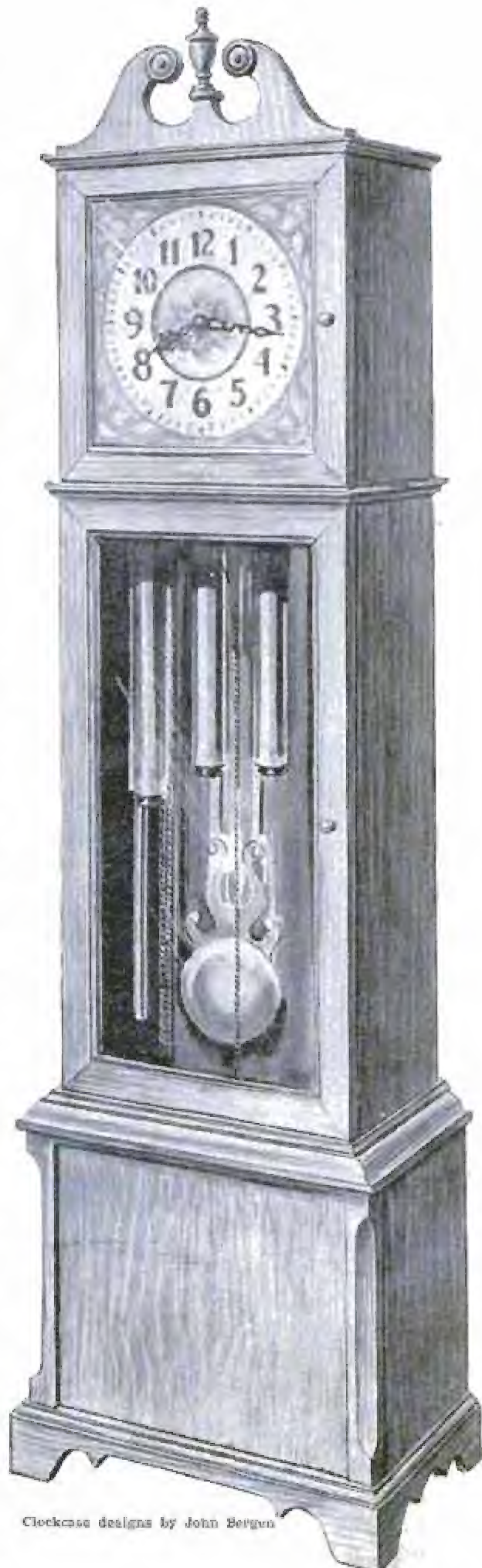
PART II

IF THE grandfather clockcase presented last month was too massive for your particular home, you may find this smaller grandmother version more suitable. It stands about 6 ft. tall and is considerably less difficult to build than the grandfather clockcase since the hood is greatly simplified. The case is designed to accommodate a standard clock movement which you can buy as a kit and install yourself.

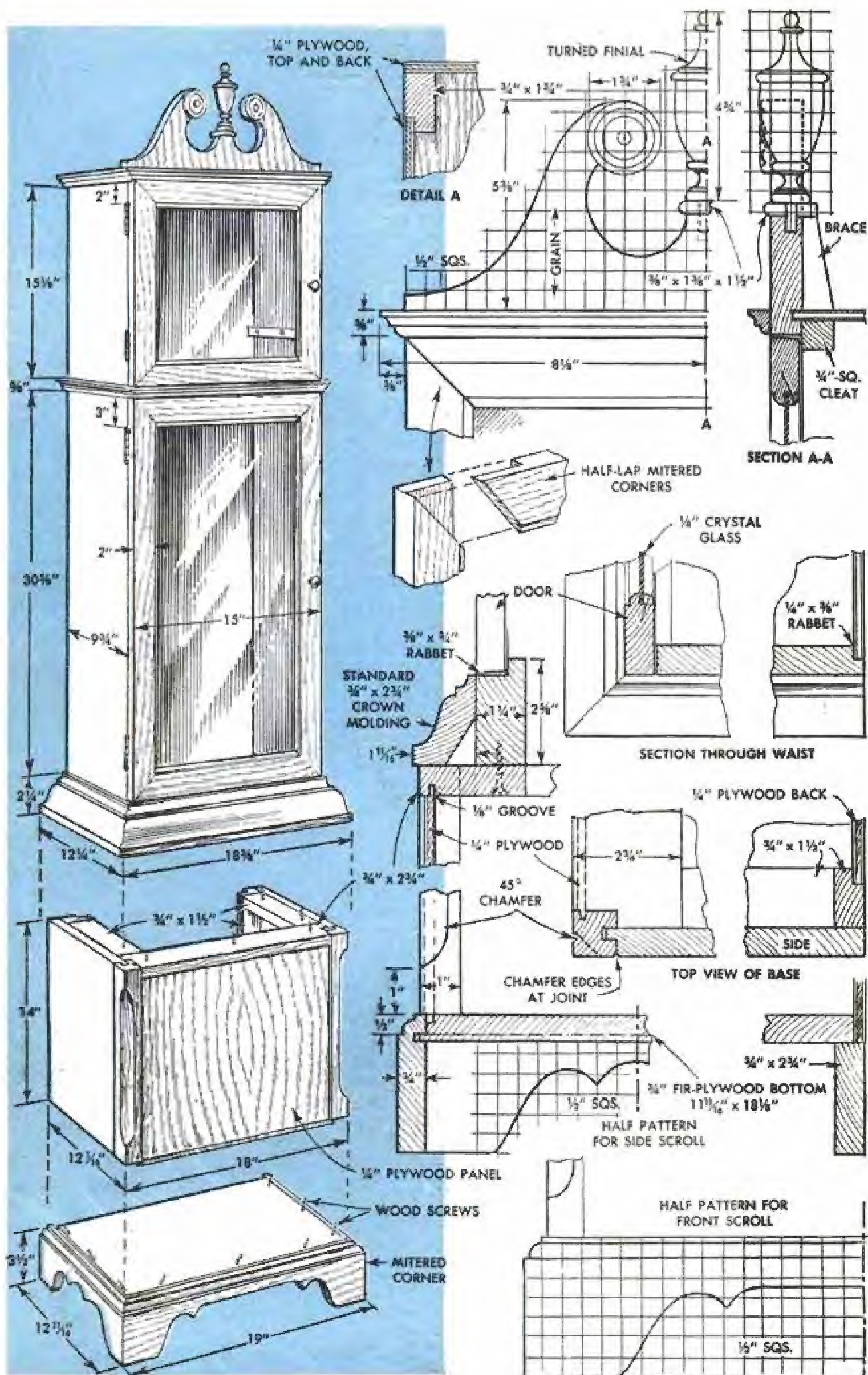
The case consists of three separate sections which are assembled individually and then joined together as a single unit. Either mahogany or walnut may be used, selecting the wood for beauty of grain and uniformity of color.

Start With the Sub-Base

Construction details are given on the following page. You'll notice that the base actually has a sub-base. Make this part first. The top requires a piece of $\frac{3}{4}$ -in. plywood, $12\frac{7}{8}$ in. wide and $17\frac{3}{4}$ in. long. This allows stock for making $\frac{1}{4}$ x $\frac{1}{4}$ -in. rabbet-tenons around three sides to fit grooves in the scrolled base members. A $\frac{1}{8}$ -in. groove is formed in the sub-base for the front plywood panel by making a second rabbet cut across the front top corner. Thus when the front scroll member is in place, the rabbet becomes a groove. The scrolled side members extend $\frac{1}{4}$ in. at the back, and a $\frac{3}{4}$ x $2\frac{3}{4}$ -in. brace is fitted between them across

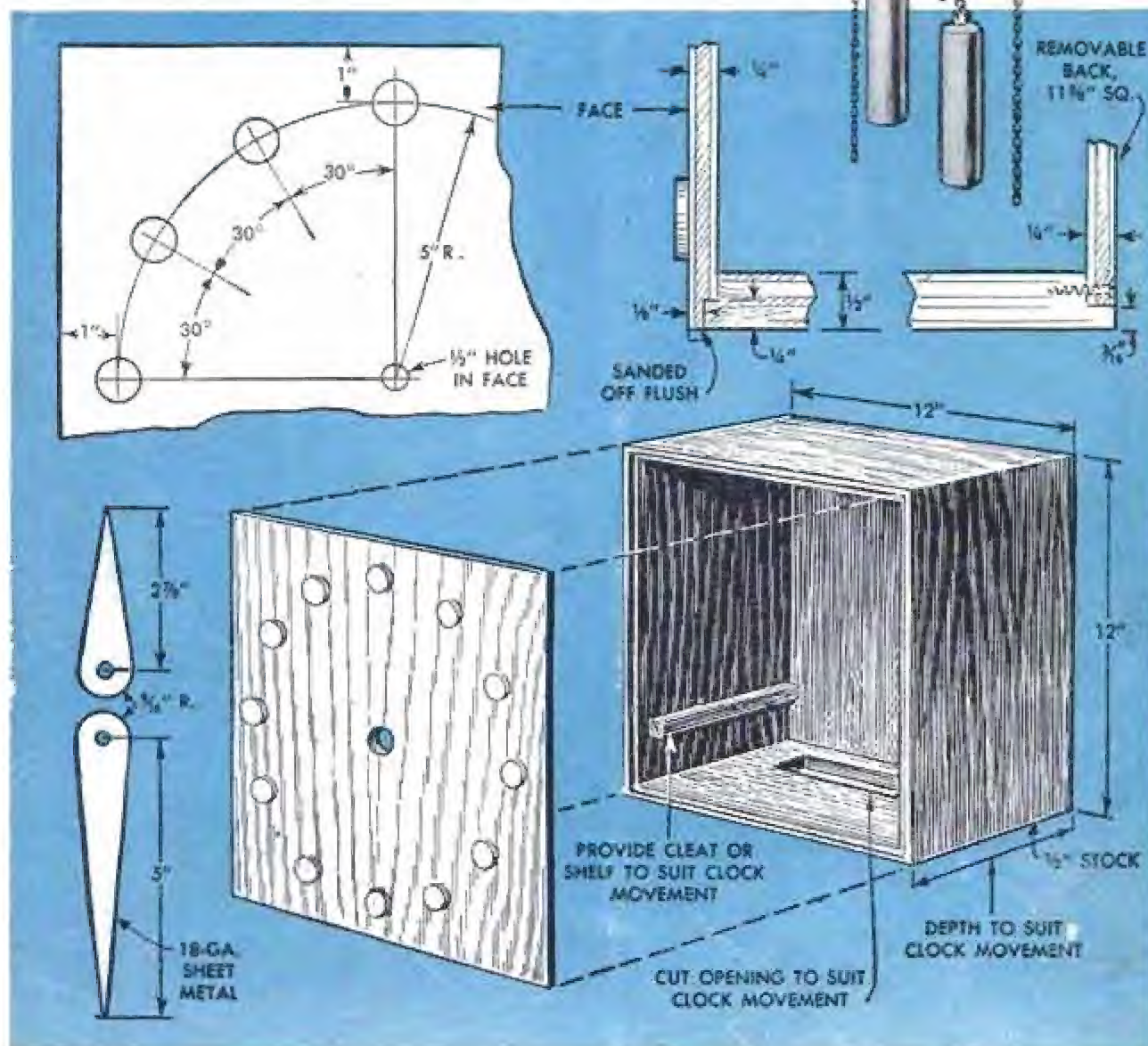


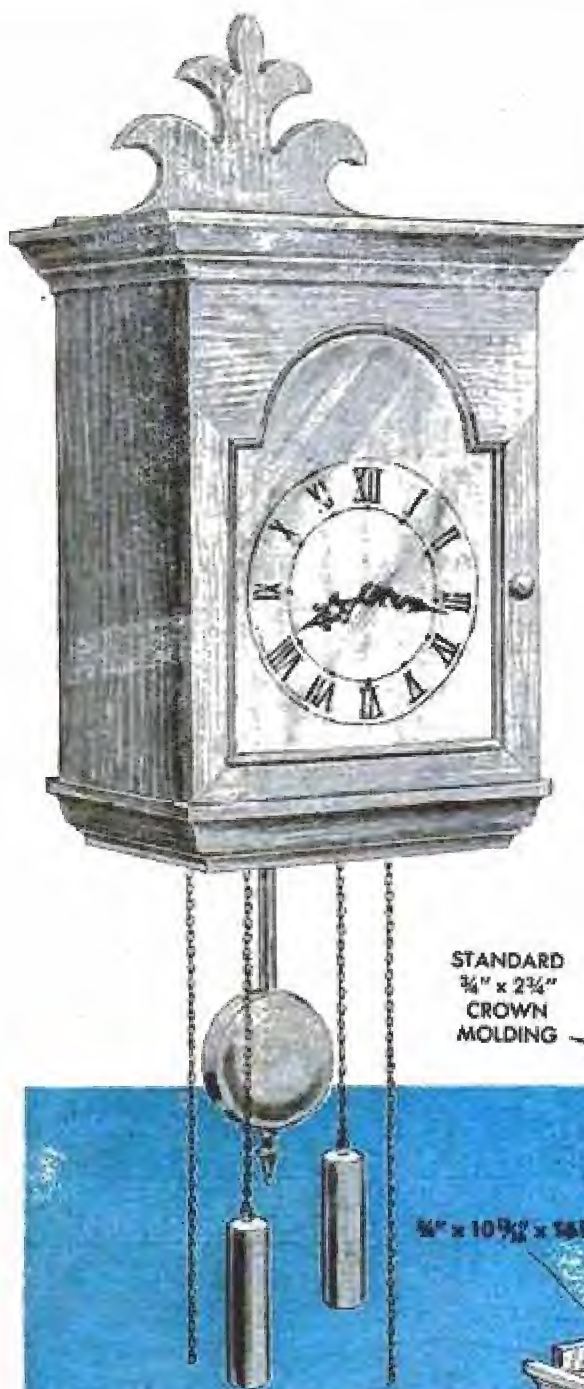
Clockcase designs by John Bergun



the back. The top edges of the scrolled pieces are shaped, which can be done on the saw with a molding head or on a regular shaper. The front corners of the members are mitered before they are scroll-cut, after which the parts are assembled with glue and finishing nails.

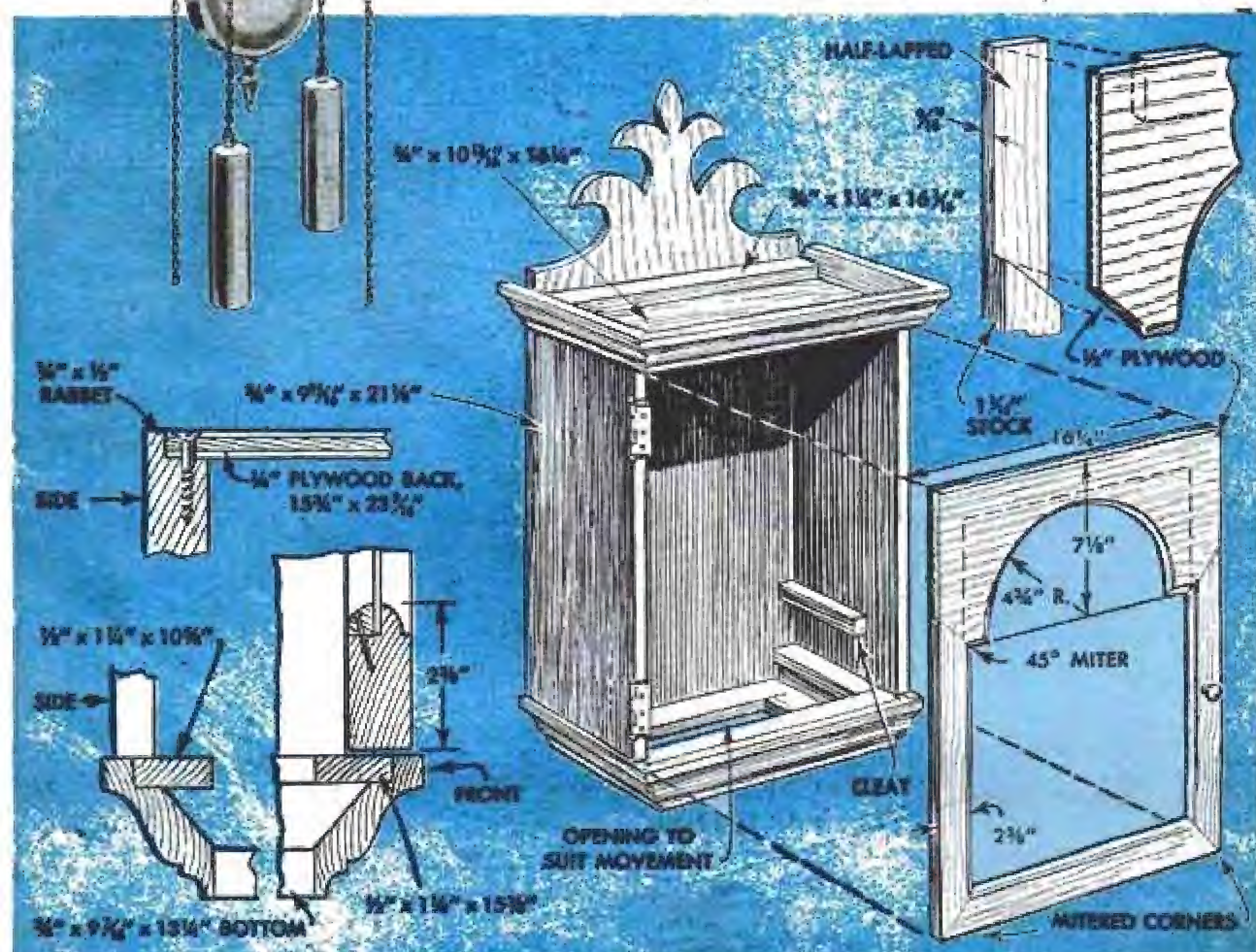
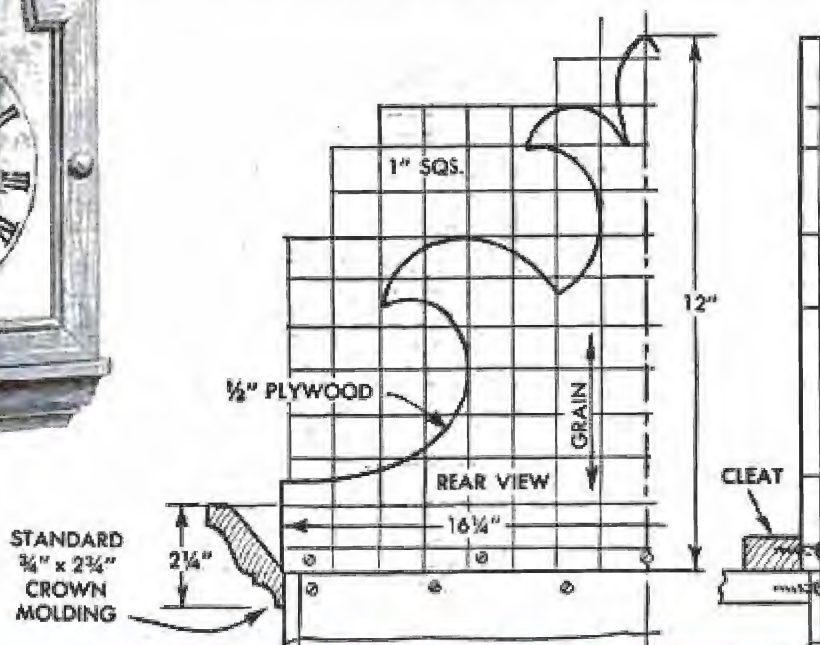
The sides for the upper part of the base measure $\frac{3}{4} \times 11\frac{1}{16} \times 14$ in. Tenons are formed along the inside front edges by rabbeting as shown in the top-view sectional detail. These edges are fitted with 1-in.-sq. posts, 14 in. long, which are grooved for the $\frac{1}{4}$ -in. tenons and the $\frac{1}{8}$ -in. rabbeted edges of the plywood front. Notice in the top-view drawing of the base that abutting edges of the posts and sides are chamfered slightly to form a V-joint. The outside corners of the posts also are chamfered 45 deg. to within 1 in. of each end. The plywood front panel is cut $13\frac{3}{4} \times 16\frac{1}{2}$ in. and a $\frac{1}{8} \times \frac{1}{4}$ -in. rabbet is run around the four edges. The rabbet at the top of the panel fits in a groove cut in the underside of a $\frac{3}{4} \times 2\frac{3}{4}$ -in. cleat which is notched at the ends to fit around the posts. Similar cleats, $\frac{3}{4} \times 1\frac{1}{2}$ in., are added at the top of the sides on the inside and these, as well as the cleat across the front, serve as screw cleats for attaching the waist section to the base section. Rabbeted cleats also are fitted at the rear edges of the sides to provide a screwing surface for the plywood back.





Make the Waist Next

Two pieces, $\frac{3}{4} \times 9\frac{3}{4} \times 48\frac{5}{8}$ in., are needed for the sides of the waist. These pieces also form the sides of the hood since the waist and hood actually are of one piece. The rear edge of each sidepiece is rabbeted, $\frac{1}{4} \times \frac{3}{8}$ in., to receive the plywood back and then the pieces are glued and screwed to the base section. Place them $1\frac{1}{2}$ in. in from edges so the waist will be 15 in. wide and drive the screws up into the end grain through the cleats provided. Temporarily brace the assembly at this stage.



Next, cut a piece $1\frac{1}{4} \times 2\frac{5}{8} \times 13\frac{1}{2}$ in. to fit between the sides at the front. This piece is rabbeted along the top edge to provide a ledge for the waist door, after which it is glued and screwed directly to the base section, keeping it even with the front edges of the side members. Drive the screws up through the $2\frac{3}{4}$ -in. cleat. Standard crown molding is used to finish off the base at the top. This is allowed to overhang the base about $\frac{1}{8}$ in. at the sides and front and is mitered at the front corners and then glued and nailed to both the base and waist. Notice that the top of the molding is kept even with the door rabbet.

Standard $\frac{5}{8}$ -in. glass-bead molding applied to the waist at a point $30\frac{5}{8}$ in. up from the crown molding makes the hood appear as a separate section. Although not shown, a rabbeted T-shape cleat is fitted between the sides at the front to provide stops for the doors and a backing strip for the front molding. This cleat is cut from a $1\frac{1}{4} \times 1\frac{1}{4} \times 13\frac{1}{2}$ -in. piece and a rabbet, $\frac{1}{4} \times 1\frac{3}{16}$ in., is formed along the top and bottom front edges. Glue and finishing nails are used to fasten the cleat to the sides before the molding is applied.

Finally the Pediment

Notice in the broken pediment at the top of the hood that the grain runs vertically. This means you will have to edge-glue two or more pieces to make up the 15-in. width required. You'll need a piece 6 in. long. A $\frac{1}{4} \times \frac{1}{4}$ -in. groove is made along the lower edge on the back of this piece to receive a $\frac{1}{4}$ -in.-plywood top piece. The latter is cut $10 \times 10\frac{1}{2}$ in. so it will lap the edges of the sides. Notice in section A-A that a $\frac{3}{4}$ -in.-sq. cleat is added to the underside of the top to form a stop for the hood door. Turned rosettes, $\frac{1}{4}$ in. thick, are applied to the face of the pediment after it is jigsawed, and a turned finial is mounted at the center. Finally, molding is added around the top of the hood, letting it cover the plywood edges of the top piece at the sides. A rabbeted cleat, $\frac{3}{4} \times 1\frac{3}{4}$ in., is fitted across the back at the top, as in detail, to support the removable back.

The doors are assembled from $\frac{3}{4} \times 2$ -in. rabbeted stock and are half-lapped and mitered at the corners. The glass is held in place with quarter-round molding fastened with brads.

Modern Wall Case

This case, page 199, is of boxlike construction, the depth of which is made to suit the particular movement the case is to house. Either a true weighted or an electrical or mechanical movement may be installed. If the latter, dummy weights, chains and pendulum can be attached to the bottom of the

Finishing Your Clockcase

The first step and, perhaps, the most important step in applying the finish to your completed clockcase, is the sanding. This should be done carefully and thoroughly, starting out with 2/0 paper and then using progressively finer grades.

The second step is dusting. Use a clean, dry paintbrush for this and a tack rag to pick up surface dust. The latter can be purchased at most paint stores or you can make one by pouring a little varnish on turpentine-saturated cloth and wringing dry.

The third step is to apply a non-grain-raising (NGR) stain. This can be applied with either brush or spray and is left to dry for about 30 min.

The fourth step is to apply a wash coat of white shellac or clear lacquer over the stain. This should be water-thin. If shellac, mix alcohol, 4 parts, shellac, 1 part.

The fifth step is to fill the pores of the wood, assuming you are finishing mahogany or other open-grain wood. Use a dark paste filler and brush it on with the grain. Then after it flattens, wipe filler off across grain with coarse cloth and finish wiping with grain.

The sixth step is to seal the surface with a coat of sealer. This can be shellac thinned 2 to 1.

The seventh step is to smooth the sealer with 6/0 garnet paper and dust off, using a tack rag.

The eighth step is to apply mahogany pigment stain. Brush this on and then wipe stain with a coarse cloth, shading it lightly and leaving more stain at the edges.

The ninth step is to apply a top coat of lacquer or varnish, using either brush or spray.

The tenth step is to rub down the top coat with rubbing compound, using a felt or burlap pad. Rub with the grain.

case for effect. Veneer-faced plywood, $\frac{1}{2}$ in. thick, is used for the four sides of the case and the front and back edges are rabbeted as detailed to receive a $\frac{1}{4}$ -in. plywood clockface and a $\frac{1}{4}$ -in. plywood removable back. The corner joints of the case employ rabbeted joints also. Here the rabbets are made to overhang the edges a bit so they may be sanded off flush after assembly. Numerals on the clockface are $\frac{1}{8}$ -in.-thick disks sliced from $\frac{3}{4}$ -in.-dia. brass, copper or aluminum rod and polished. Cut the hands from 12-ga. sheet brass, copper, aluminum or stainless steel.

Traditional Wall Case

This case, detailed in the drawings on the facing page, is somewhat more involved. Start by cutting the sides to size from $\frac{3}{4}$ -in. material. A $\frac{1}{4} \times \frac{1}{2}$ -in. rabbet is cut in the rear edge of each sidepiece for a $\frac{1}{4}$ -in. back panel. The sides are glued and nailed to a $\frac{3}{4}$ -in. top piece which fits between them, and then standard crown molding is applied to three sides, mitering it at the front corners. The same type molding is used around the bottom of the case, rabbeting the upper edge of the molding to fit a three-sided frame on which the sides rest. The scrolled ornament is cut from $\frac{1}{2}$ -in. veneer-faced plywood, the grain running vertically. This is glued and screwed to a cleat attached to the top of the case. A bottom board, having an opening cut in the center, is fitted in the bottom of the case and the back panel is screwed to the rear edge of it. The door is made as detailed. ★ ★ ★

KNOW YOUR SHOP MOTORS

By J. R. Williams

PART II

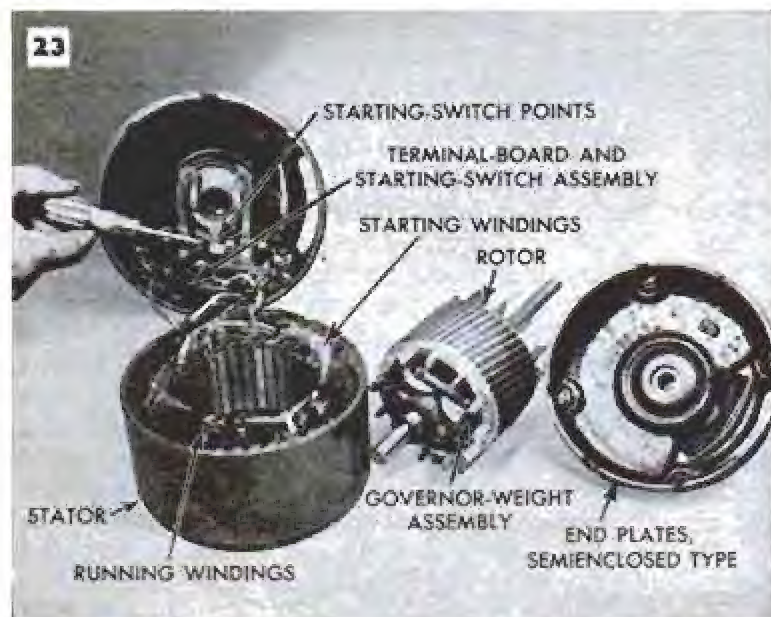
WHEN YOU PURCHASE an electric motor, especially a used one, for use in your workshop, the first step is to check the name plate, which gives the current characteristics, speed of the motor, type, frame number and, on motors designed for operation on 110-220-v. current, will include wiring diagrams showing how to interchange the motor leads for operation on either voltage. The name plate also will indicate whether the motor is for operation on single-phase or polyphase current, 60 cycles or less, a.c. or d.c. It's important to make this check before you test-run a used motor. Motors designed to operate on single-phase current will not operate on polyphase (2 or 3-phase) current. Motors wired for operation on 110-v. current only will be damaged if connected to a 220-v. circuit. Only universal-type motors will operate on either a.c. or d.c.

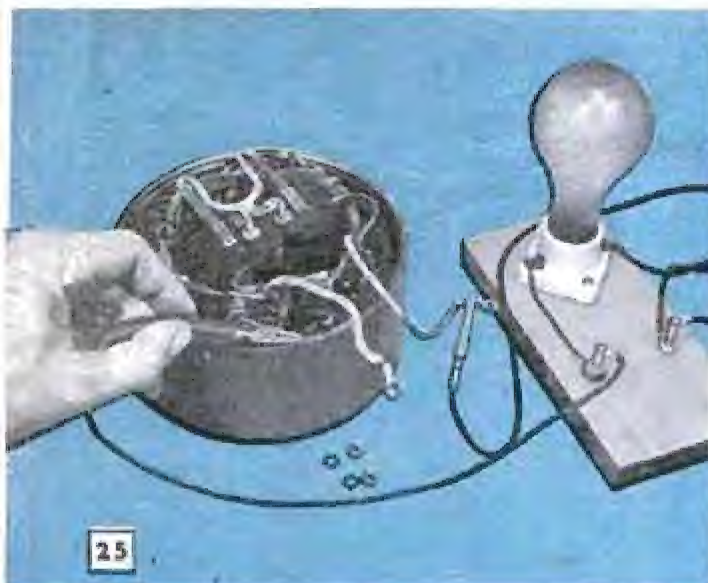
After checking the name plate, test-run fractional-hp. motors by plugging into the proper power source. If the motor hums but will not start, spin the shaft by hand. If the motor starts and runs at full-rated speed, then it is likely that the starting switch is at fault. Note the starting and running positions of a typical centrifugal switch, Figs. 27 and 28. As a rule this defect is easily corrected by a thorough cleaning of the parts, using carbon tetrachloride.

The outward appearance of a used motor



cannot always be relied on as an indication of its condition. Press the shaft in and out several times. Excessive end play indicates worn spacer washers, Fig. 26, also part No. 8 in Fig. 27. Turn the shaft slowly by hand. If it binds at any point in one complete revolution, three possible defects are indicated. The bearings, either ball or sleeve type, may be badly worn, may even permit the armature to strike the stator bars as it rotates. The armature shaft may be bent. In a repulsion-start motor the commutator may be grooved due to wear, or the brush-mounting ring may be damaged. Worn bearings, especially sleeve bearings, are





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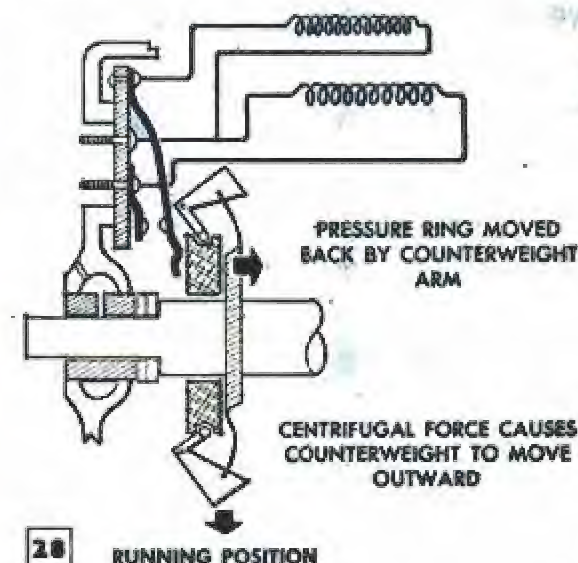
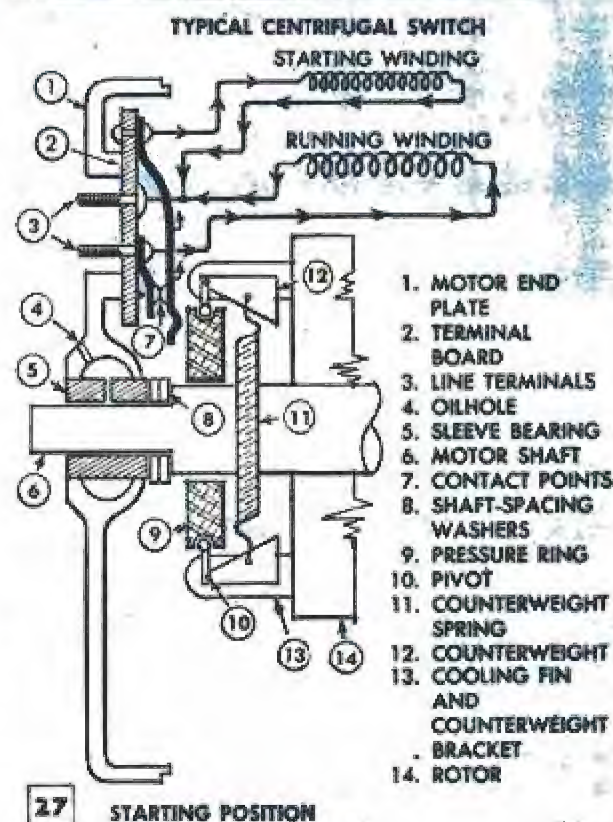
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easily replaced, but if the motor has a bent armature shaft or is otherwise damaged it is seldom worth the necessary repairs.

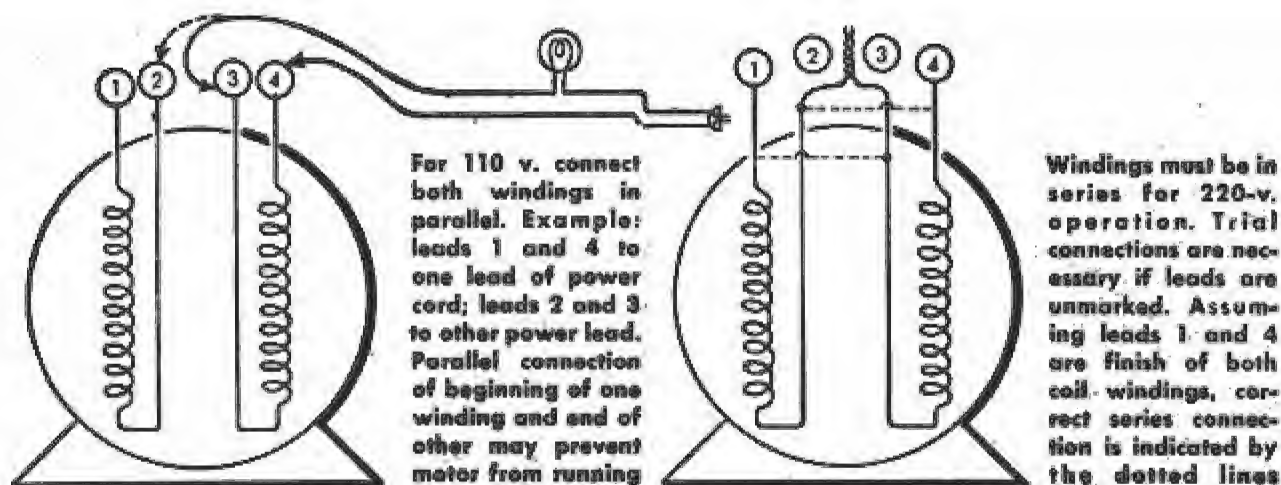
In order to replace sleeve bearings it usually is necessary to disassemble the motor to the stage shown in Fig. 23, which pictures a motor of the capacitor type. Sleeve bearings are removed from the end shields with a shouldered rod, Fig. 29, and are replaced as in Fig. 22, using the drill press as an arbor press.

While you have the motor disassembled clean all parts thoroughly, being especially careful to see that the air passages in the stator frame are free from dust and other foreign matter that may interfere with air circulation. If the motor is of the repulsion-start type, the brushes may need replacing and it is possible that the commutator will require undercutting and truing up. The commutator job should be taken to a shop equipped for this special work.

When testing salvage motors in order to select one which is serviceable, it will help



29



30

TWO-VOLTAGE REPULSION-INDUCTION WIRING

to improvise the test unit pictured in Figs. 25 and 31. This unit provides a fuse in the cord from the current source, Fig. 31, which can be used to check the motor for actual operation. By substituting a lamp bulb for the fuse in the test block the unit provides a continuity light for testing motor circuits, Fig. 25. To test the starting and running windings separately, mark the winding leads with pieces of colored or marked tape and remove one pair of leads from the terminal plate. Clip the test leads across the removed leads and plug the line cord into a 110-v. source. The test lamp will light if the motor wiring circuit is complete. Failure of the lamp to light indicates an open circuit. If the circuit under test shows continuity (lamp burns), remove one test lead and touch it to the motor frame. If the lamp burns, it indicates a short circuit which must be corrected or the motor discarded.

Next, the free test lead is touched to one of the winding leads remaining on the terminal block. If the test lamp lights, it indicates a short circuit between the two sets of windings. Again it will be necessary to locate the short and correct it before the motor can be considered serviceable. The second set of windings is tested for open circuits in the same manner, removing the circuit leads for this set of windings from the terminal plate, or closing the starting-switch contacts to obtain a continuity indication on the test block.

If the initial running test showed the motor to be somewhat slow in starting, the capacitor may be at fault. If there is reason to suspect a faulty capacitor, either discard the motor or, if the capacitor is of the removable type (mounted on the outside of the motor frame), remove and have it tested at a shop having suitable testing equipment. If this test shows it to be faulty, it should of course, be replaced. Field windings of repulsion-start motors, Fig. 30, can be

checked in the manner just described, but the armatures are wire-wound and must be checked on an armature growler.

When reassembling a motor that has been disassembled for any reason, be sure that the end shields are seated correctly and that the through bolts are tightened to a uniform tension. Be sure also that all wire leads inside the motor are so located that they cannot come in contact with any rotating part. On brush-type motors be especially careful to see that the brushes are correctly located in the holders. If the original brushes were found to be in serviceable condition when removed, place them in order on the bench where they will not be disturbed. In this way they can be replaced in the holders in the same order and in the same position as they were before they were removed from the motor.

When the motor has been assembled, turn the shaft slowly by hand. On capacitor-type motors the shaft should turn freely without the slightest tendency to bind at any point. On repulsion-start motors having axial-type commutators with the brushes always in contact, there will be a slight drag due to contact of the brushes. It is important that this be uniform throughout the entire revolution. On brush-lifting motors the shaft will turn freely, of course. If the motor passes this check, test-run it before putting in service.

On repulsion-start motors some provision is always made for changing the direction of rotation. This usually is done by shifting the brushes. Fig. 24 pictures an older-type motor with two index marks and a pointer on the end shield. Loosening the screw and moving the pointer to the opposite index mark will shift the brushes and reverse the motor.

The chart outlines the common methods of motor trouble shooting. It is not, of course, all-inclusive, but does cover the common procedures. ★ ★ ★



MOTOR TROUBLE-SHOOTING CHART

Split-Phase and Capacitor-Start Motors

Symptoms	Possible Cause	Remedy
Motor hums, but fails to start	Excessive overload	Remove load from motor
	Worn or tight bearings	Check bearings; replace if worn, ream if tight
	End plates improperly tightened, causing shaft to bind	Tighten all bolts to insure proper seating
	Open running winding	Check continuity; if open, check for break in coil connections and leads
	Open starting winding	Same procedure as above
	Centrifugal-switch contact points dirty	Check for continuity through contact points, clean as required
	Centrifugal-switch contact points not closed	Add fiber washers at opposite end of the shaft
Motor fails to attain normal running speed	Grounded windings	Check starting and running windings for ground; if ground exists, correct condition as required
	Overload device open-circuited	Check continuity. Replace if defective
	Short circuit in running winding (internal short)	With hand, check main poles of motor to determine if one or more is heating excessively. Usually an internal short requires replacement of the winding
	Starting winding remains in circuit	Contact points may be stuck together (centrifugal switch). Centrifugal throwout device may be defective. Check entire assembly, repair as required
	Incorrect polarity of stator poles	Would result only if individual windings had been disconnected. Check polarity with compass; reverse connections on individual winding leads if necessary to change polarity
	Rotor dragging on stator	Replace worn bearings
	Loose rotor bars	Check rotor on growler. Replace or repair as required

Split-Phase and Capacitor Motors

Symptoms	Possible Cause	Remedy
Motor runs hot	Motor overloaded	Allow motor to run without load to determine if overload is cause
	Running or starting winding internally shorted	Replacement of the winding is usually required
	Windings grounded at several points	Check for grounds with continuity light. Correct as required
	Short circuit between running and starting windings	Check with continuity light. Correct as required
Motor noisy	Motor dirty	Dirt and lint possibly hindering air circulation. Blow out dirt with high-pressure air
	Shorted winding, improperly connected poles, loose rotor bars	These conditions produce a magnetic hum; the remedy has been discussed under symptoms above
	Worn bearings, worn centrifugal-switch parts, foreign material in motor	Mechanical defects causing noise, correct by replacing defective parts

Capacitor Motors Only

Motor fails to start	In addition to causes listed under split-phase types. Open circuit in starting capacitor	If motor will start after shaft is first turned manually, and the centrifugal switch and starting circuit are in order, check capacitor. Replace if defective
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Repulsion Motors

Motor fails to start, or does not start properly	Brushes stuck in holder	Check brushes for free movement
	Worn brushes	Determine if brushes are contacting commutator
	Open circuit in stator	Check windings for continuity
	Open circuit in armature	Check armature in growler
Motor heats excessively	Dirty commutator	Clean with sandpaper
	Armature-shorting device sticking in running position	Check centrifugal throwout device; clean
	Shorted armature. Brush holder in wrong position	Check in growler. Try shifting brush holder to different positions
	Operation on the wrong voltage	Check connection of field leads to determine whether they are wired correctly for operating voltage
Motor sparks internally	Shorts and grounds in field windings or armature	Inspect and correct as given under split-phase types. Check armature on growler
	One or more open armature coils	Check continuity from one commutator segment to another, or check armature on growler
	Sticking brushes	Check brushes for free movement. Clean brushes and brush holder
	High mica on commutator, causing brushes to jump	Chuck armature in lathe, turn down commutator section

Can on Trailer Wall Provides Running Water in Isolated Area

Tap water can be supplied to an isolated house trailer by means of a hose attached to a 5-gal. reservoir constructed from a



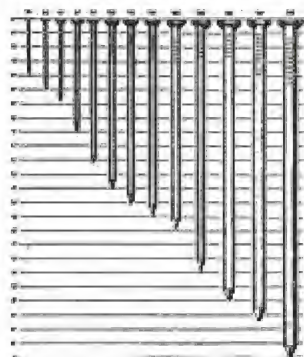
war-surplus water can mounted on the outside wall of the trailer. Use a can with an enameled inside surface and originally intended for water. From a length of aluminum channel cut two L-shaped brackets about 2 in. long and bolt them to the can as shown in the detail, using fabric washers on the inside as a seal. Cut the mounting bar from flat aluminum stock long enough to reach across two studs of the trailer wall, and of a thickness that will fit snugly in the can brackets. Use spacers between it and the wall, and install it as high as possible, taking into consideration the weight of the can and the convenience of the location. The can must be hung above the height of the sink tap inside the trailer for the water to flow. Next, drill a hole in the edge of the can as close to the bottom as possible, leaving room for the flange of a faucet to clear the beading at the bottom of the can. Use a 1/2-in. brass or bronze faucet and place a rubber gasket, flat washer and a nut on the inside. Braze or solder the flange to the outside of the can. Run a hose from the can to the trailer fresh-water intake and your mobile home is equipped with running water.

Jesse D. Cope, San Diego, Calif.

Do-It-Yourself MATERIALS GUIDE for the Homeowner and Handyman

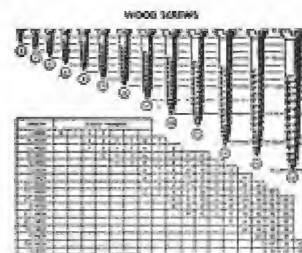
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SHOP NOTES

MULTIPURPOSE POWER TOOLS

WHERE SPACE is the main problem in equipping your home shop, a multi-purpose power tool can be the answer. These units reduce floor-space requirements to the point where you can usually set up shop in the end of the garage or in a corner of the utility room and still have space left over in which to work. Multi-purpose tools are one-motor units, a feature which reduces not only the space requirement but also the initial cost. Which one to select is more a question of personal preference than of quality or utility.

Many craftsmen will prefer the radial saw, upper photo at the right, which is not only a power saw but can be converted into a groover, shaper, sander, drill and wood lathe with accessories which are available at a reasonable cost. All radial machines pictured in the accompanying photos share a common advantage, that is, you can buy



Comet



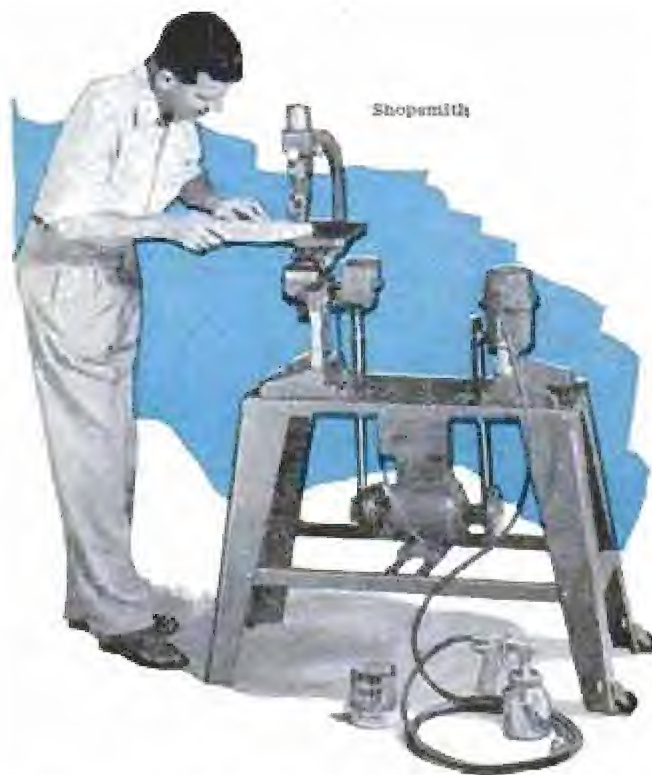
Duro



Shopsmith

In many home shops a radial saw will prove the best choice in a multi-purpose power tool. It not only will perform all sawing operations as in the top photo, but with accessories will cut dados, moldings, make turnings and do other cabinet-making jobs. Center, saw-jointer combination also is good choice

Left, multipurpose machine for the craftsman who wants a compact unit combining several machines in one requiring the minimum shop space. All cabinetmaking operations can be done on this machine, including full-length table-leg turnings. As pictured, the machine is set up as a horizontal drill



Jigsaw and paint sprayer mounted on a stand and driven by one motor. Tool mounts on stand also take bandsaw, jointer and sander in handy combinations

the basic radial saw and add whatever accessories are suited to your needs.

Craftsmen who like to build modern home furnishings and have no present need for a lathe can settle for the saw-jointer combinations, several of which are pictured. Other than turnings, these two-ma-

chine units provide all that is necessary for cabinet joinery of professional quality and workmanship. You can take a piece of stock quickly through all necessary operations of ripping to width, cutting to length, planing to thickness, grooving, rabbeting, jointing and molding—whatever is necessary to ready it for use in a project—all without shifting machines, belts, or motor. One manufacturer of saw-jointer combinations includes a folding drill press, making a three-machine unit as in the lower right-hand photo, page 211. Both the radial saws and the saw-jointer combinations are fitted with tilting saw arbors, making it possible to cut off stock at any angle, including compound miters. Another saw-jointer unit includes a disk sander as regular equipment as in the lower right-hand photo, page 209.

A third type of combination, or multi-purpose, machine is a good choice for the craftsman who wants the nearest approach to a complete power shop in a one-motor tool. You see it pictured in the lower photo on page 207. With this unit a number of machines can be set up simply by shifting component parts of the basic machine. Accessory machine units such as a jointer, jigsaw, bandsaw, belt sander and paint sprayer are mounted individually on the frame of the basic machine and driven by power take-off shafts. In several of the accompanying photos you see it set up as a vertical and horizontal drill press, shaper, disk sander, router and wood lathe. A similar machine of much the same versatility,

Here's a radial saw cutting dados (grooves) at an angle across width of stock. Saw blade has been replaced by a dado head to cut groove in one pass

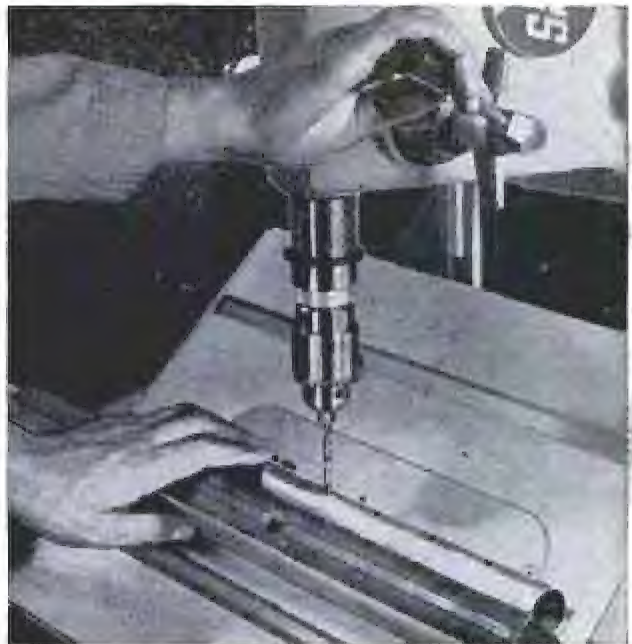
DeWalt





Paramount

Multipurpose tool set up for angle drilling. Saw table is used as drill table. Ripping fence serves as stop. Head can be set to drill horizontally



Here ripping fence and saw table form V-block for drilling spaced holes in one wall of metal tubing. Speed of spindle can be varied to suit drilling job



Above, disk-sanding a compound angle to smooth surface for perfect fit of hopper joint. Below, multi-purpose tool set up for grinding hand tools such as plane irons, knives, chisels and wood-turning tools

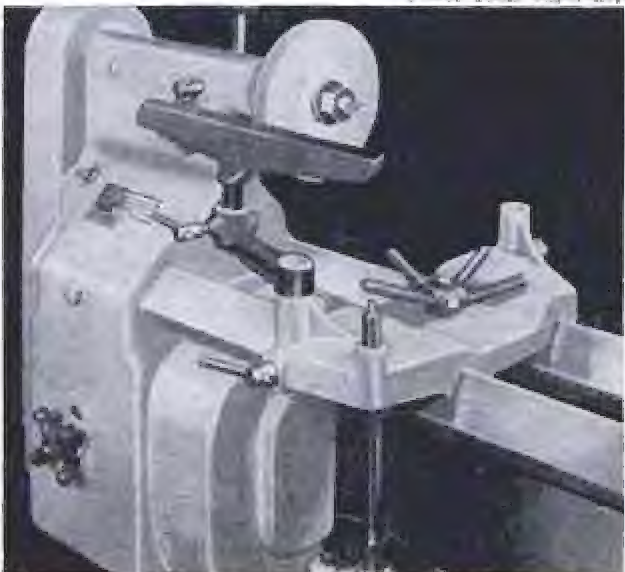
Power Tools Superstore

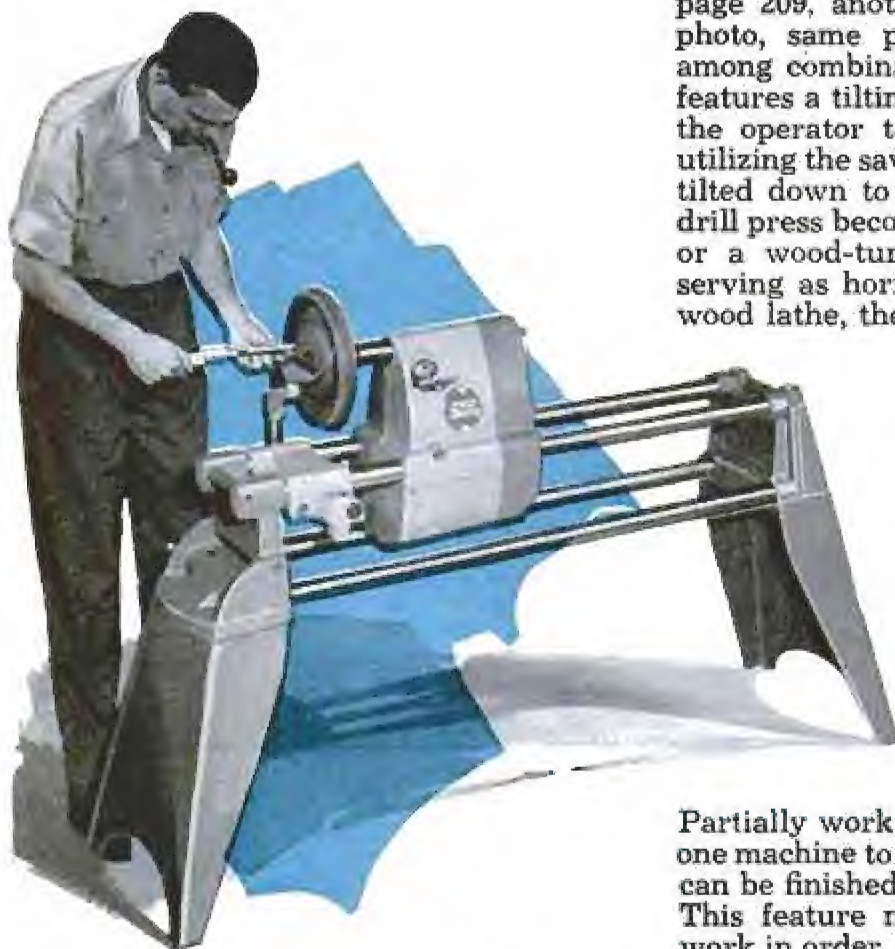


Delta

Above, radial saw set up to crosscut a large plywood panel. Job being done is a good measure of the capacity of these machines. Below, saw-jointer-disk-sander combination has all three units in easy reach

Yates-American





It takes less than a minute to set up this tool as a faceplate lathe. Just remove saw table, substitute faceplate for saw arbor, insert tool rest and there you are. Simple turn of the dial varies spindle speeds

Wide grooves can be cut with saw blade simply by shifting blade after each pass of stock a distance equal to width of saw kerf, the table height being set beforehand to give a groove of required depth

is pictured in the lower left-hand photo, page 209, another in the upper left-hand photo, same page. The latter is unique among combination power tools in that it features a tilting drill-press head, enabling the operator to drill holes at any angle, utilizing the saw table as a drill table. When tilted down to the horizontal position the drill press becomes either a horizontal drill or a wood-turning lathe. In addition to serving as horizontal and vertical drill or wood lathe, the machine becomes a power saw and sander with only minor accessory changes. Like the other combination units this machine is mounted on a compact floor stand.

For the user the multi-purpose machines not only economize on space and reduce first cost. They also save time and effort by correlating the various operations necessary in the construction of even the simplest projects.

Partially worked stock is not carried from one machine to another; often all operations can be finished from one working position. This feature makes it easier to keep all work in order, thus lessening the chance of error in measuring and cutting stock. On all the types of machines pictured, change-over time has been reduced to the minimum. Many units are fitted with casters and can be rolled to the job. ★ ★ ★

Craftsmen who regularly work with small parts of wood and have no need of a large saw table or a jointer larger than 4-in. cutting width will like this saw-jointer combination with simple one-motor drive





By combining offset tailstock with which the machine comes equipped with a turning tool clamped to tool rest, operator can run tapered turnings on a production basis. Tailstock has offset settings which enable operator to obtain desired variations in taper



Delta-Crane

Saw-jointer combination is of a heavier type suitable for cabinet shops and builders, also do-it-yourselfers who require a machine of greater capacity. Saw takes 10-in. blades and jointer surfaces stock up to 6 in. wide. One motor powers both machines



Sanding a perfectly round disk is easy with the setup pictured. Here wooden disk is drilled to take a pin attached to crosscut-guide bar. Table is moved in or out to give work the correct radius



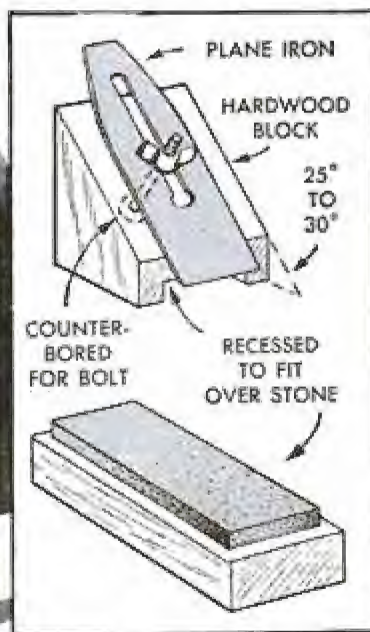
Routing at an angle with surface of work stops most individual machines, but here you see it done on a multipurpose tool, using the saw table and ripping fence to give the job the required accuracy

Another setup with a multipurpose tool—mortising a storm-door stile for lock. Note how saw table is used as a combined stop and guide to hold the work in alignment

Hinged drill press driven off saw arbor is the novel feature of this basic saw-jointer combination tool. When saw table is to be used, V-belt is removed from arbor and drill press is swung down, leaving the saw table clear for other operations

Delta

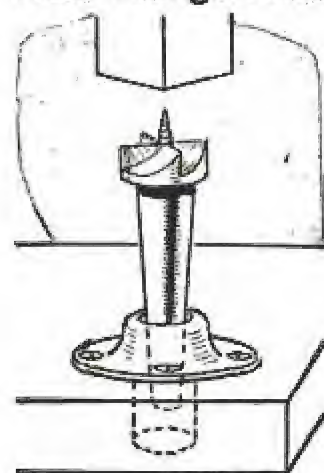




Sliding Jig Supports Plane Iron For Accurate Honing

To maintain the correct bevel when honing a plane iron, mount it on a jig made from a hardwood block. The block is recessed to clear the stone yet ride on the edge of the case that holds the stone. Bevel the block at a 25 to 30-deg. angle and bore a hole for a carriage bolt perpendicular to this surface. When fitted with a wing nut and washer, the bolt will hold the plane iron securely. Wood chisels can be sharpened with the same device simply by bolting a sheet-metal clamp across the chisel.

Floor Flange Holds Lathe Center



Holding a lathe turning square steady while driving a spur center into it is no problem when the center is held upright in a floor flange mounted on your workbench top. First, a hole is drilled in the bench top and the floor flange is screwed down over it. To use the

"vise," the lathe center is dropped into it and the turning square held vertically while being tapped onto the center.

When it is necessary to cut off part of the threaded end of a bolt, first turn a nut down to the end of the threads. Then, saw off the end where desired and unscrew the nut. This will remove the burrs so that a nut can be started easily.

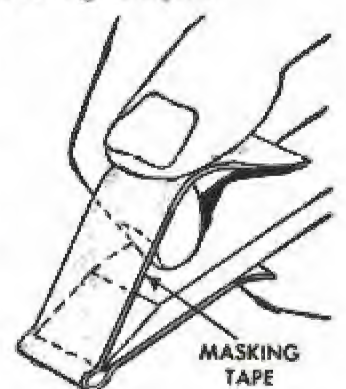
Spotting Fence-Post Holes For Tractor-Driven Auger

When drilling fence-post holes with a tractor-driven auger, here is an easy way of spotting the exact location for each hole. As the alignment and distance for each hole are measured, carry along a bucket of dry lime and a small scoop. Then, as the exact spot for each hole is located, cover it with a dash of lime. The tractor operator can readily see the exact spot on which to set the point of the auger for drilling each fence-post hole.

George A. Smith, Quarryville, Pa.

Masking Tape on Wood Chisels Protects Sharp Cutting Edges

Keen-edged wood chisels will retain their sharpness longer when carried with other tools in a toolbox, if the cutting edges are protected with strips of masking tape. Fit the tape over the ends of the chisels as indicated, so the folded portion of the tape projects and provides a "cushion" for the cutting edge. Friction or rubber tape also may be used to protect the edge.



Aluminum Rack Stores Milking-Machine Inflation Tubes

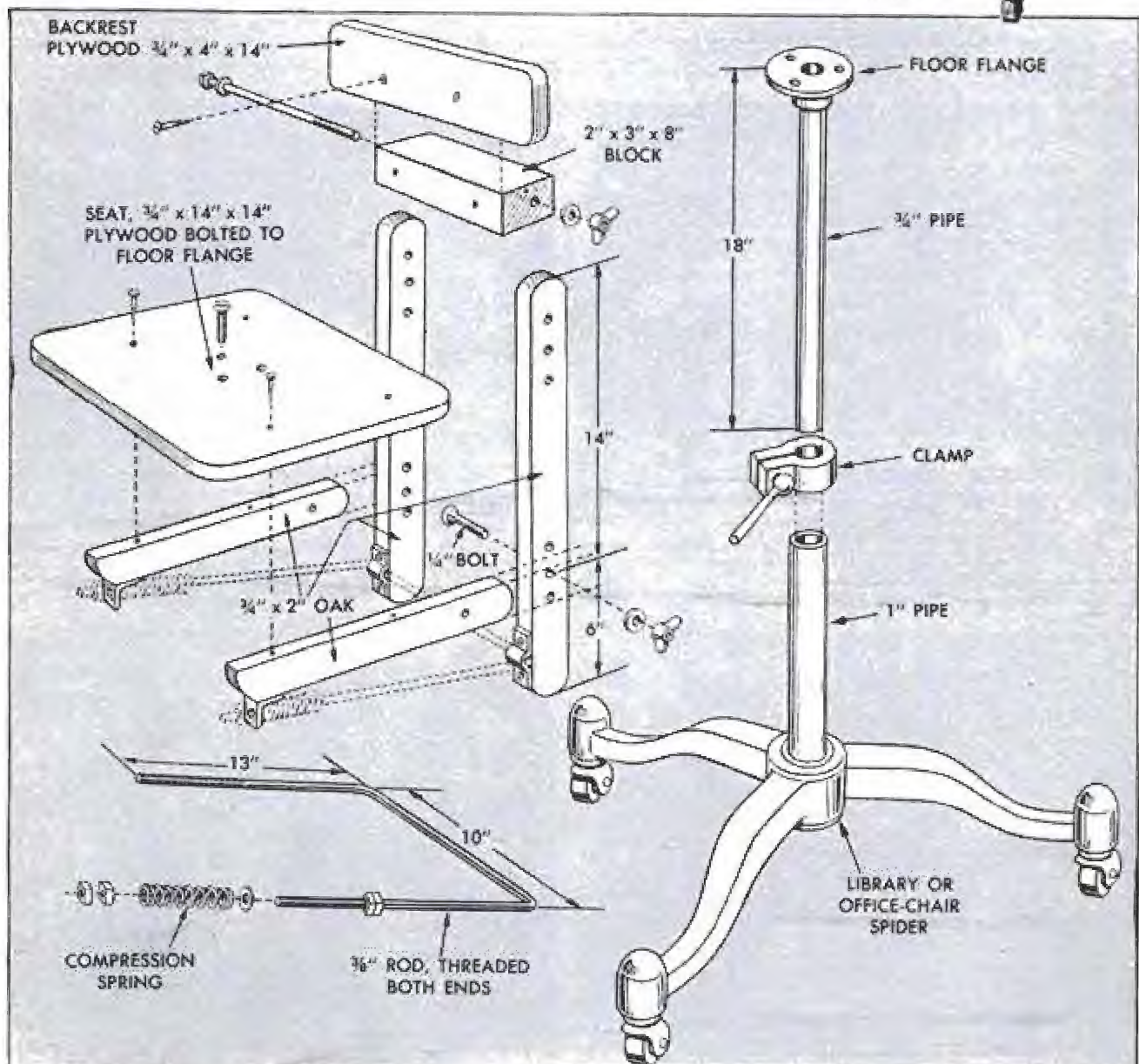
A sanitary, nonrusting and easily cleaned rack for holding the inflation tubes used on electric milking machines is made completely from "do it yourself" aluminum. Two $\frac{3}{8}$ -in. rods provide the horizontal supports, which are held by two brackets shaped from $\frac{1}{4}$ x 1-in. aluminum flat bar. The splashboard is cut from either plain or embossed sheet aluminum. Aluminum screws are used to assemble the unit.



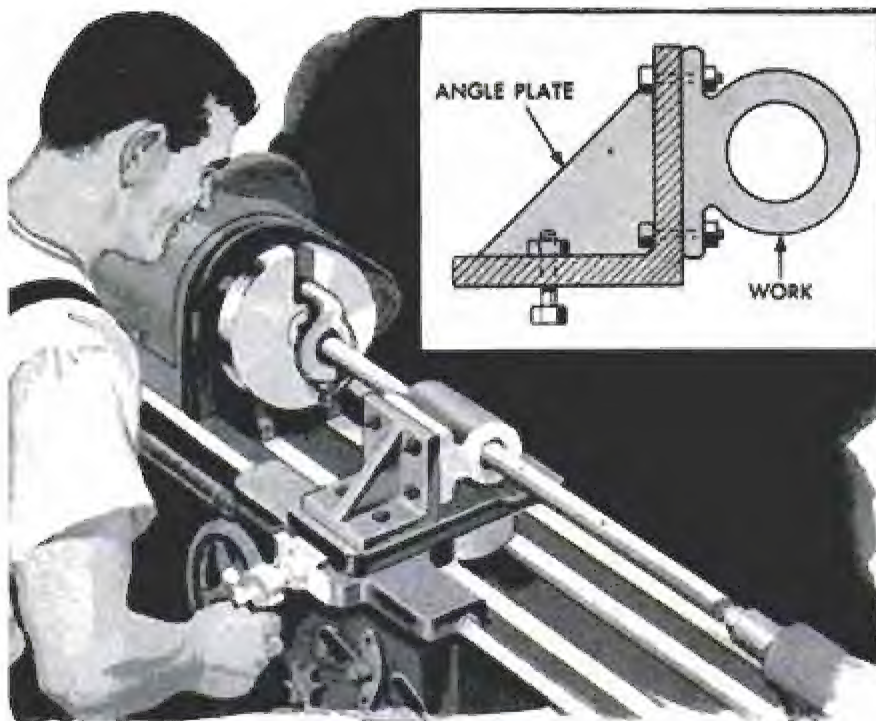
SHOP CHAIR

By Hi Sibley

ADJUSTABLE IN HEIGHT so that it can be used at bench, lathe, or drill press, this shop chair permits you to be seated comfortably for many bench and machine operations. The base of the chair is a spider salvaged from an office chair into which an 18-in. length of 1-in. pipe is fitted. The chair seat is supported on a floor flange screwed to an 18-in. length of $\frac{3}{4}$ -in. pipe which slips inside the 1-in. pipe. The clamp for locking the column can be machined from solid stock or bent from bar stock and slipped over the $\frac{3}{4}$ -in. pipe. This arrangement permits the chair to swivel. An alternate method of making height adjustments is to drill $\frac{3}{8}$ -in. holes through the pipes, spaced 1 in. apart. Alternate holes are at right angles. A $\frac{3}{8}$ -in. bolt then supports the chair column at the desired height.



SHOP



BORING OUT A CORED HOLE in a casting set up in a lathe is less of a problem when the workpiece is bolted solidly to an angle plate which is bolted to the cross slide as shown in the detail. A boring bar then is mounted between centers and is driven by a dog. With the bar turning and the work held stationary, the bored hole will be true throughout its length. A boring bar can be improvised from a length of round steel bar, with both ends center-drilled

HAND PLANE SERVES AS IDEAL SANDING BLOCK, below, when the blade is retracted, a pad of felt or thin sponge rubber placed on the bottom of the plane and a sheet of sandpaper folded over the sides of the plane. The sandpaper can be held in place with the fingers or with spring-type clips



TO PREVENT A SMALL-DIAMETER DRILL BIT from drifting off center when drilling round stock, use a piece of square stock of the same size for a drill guide as shown. The square is placed above the round stock, center-punched and drilled. The drilled hole acts as a guide to keep the bit from drifting



INDIA INK CAN BE USED FOR LAYOUT WORK, below, when there is only occasional need for layout blue. For scribing work obtain an inexpensive compass and replace the pencil with a length of dowel fitted with a nail sharpened on one end. Use a piece of adhesive tape on the work to anchor one leg of the compass

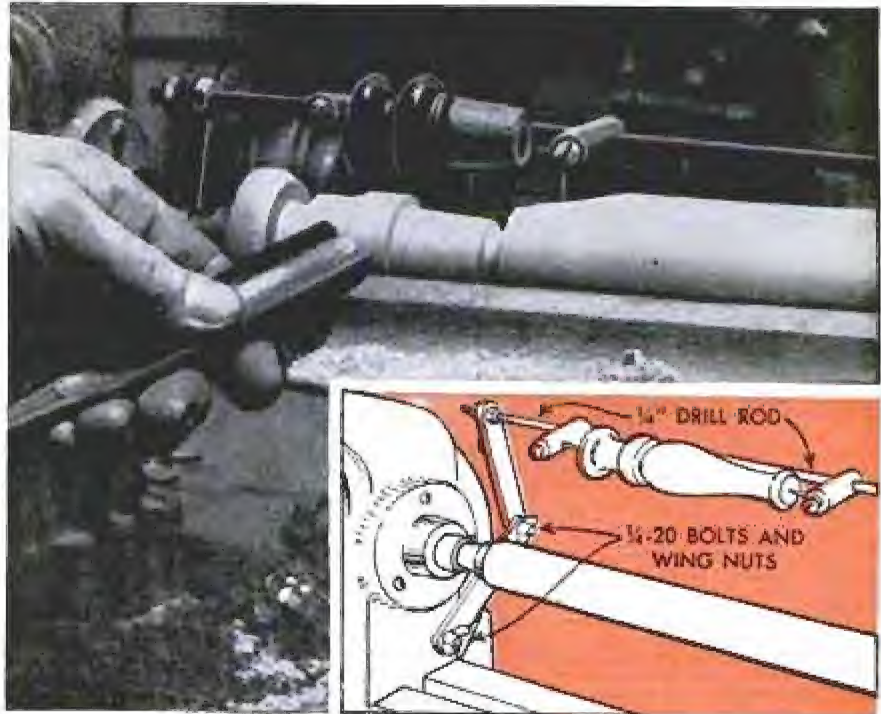


DRILLING AND TAPPING A HOLE in the arbor at the end of a flexible shaft, below, makes it possible to eliminate the weight and bulk of a conventional chuck. The hole must be centered accurately. To use various tools on the shaft, simply thread their arbors to match the tapped hole in the arbor shaft



HINTS

IF EXTREME ACCURACY is not necessary, time can be saved when turning a duplicate part on a wood lathe by holding a pattern close to the turning blank. A holder for the pattern consists of a length of $\frac{1}{4}$ -in. drill rod, threaded on one end and fastened to a flat-steel arm that pivots on a second arm which is mounted on the headstock casting. Two adjustable brass rods with a phonograph needle fitted near the end of each hold the pattern in position



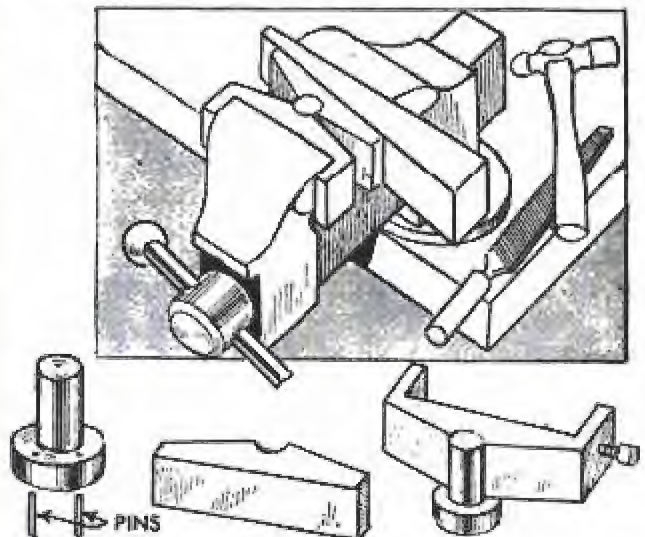
A DOWEL INSERTED IN COPPER TUBING will prevent it from becoming crushed out of round if cut in pieces less than 1 in. long with a pipe cutter. If a tight-fitting dowel is forced into a tube, it is possible to cut washers as little as $\frac{1}{8}$ in. thick



COMBINATION-SQUARE SET that includes a protractor head may be used to determine the diameter of cylindrical objects. Set protractor at 90 deg. and slide it along the scale as shown below. The diameter of an object then can be read directly from the scale



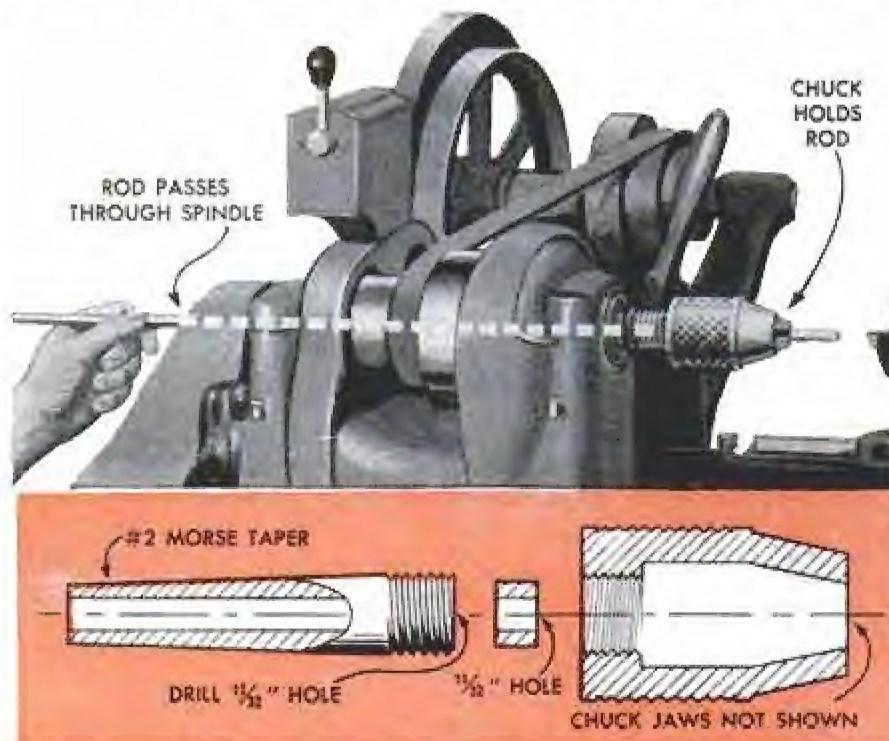
AN AUXILIARY PIVOTING JAW cut from steel plate permits holding tapered pieces of work in the jaws of a regular bench vise. The auxiliary jaw consists of two triangular pieces which pivot on a flanged pin fastened to the clamped piece by two dowel pins



THREADED CLEANING TOOL, below, can be used to remove tightly embedded metal chips from threads on a lathe chuck. The tool is made by threading a piece of steel tubing or pipe and providing a shear on the leading edge of each of three segments as shown



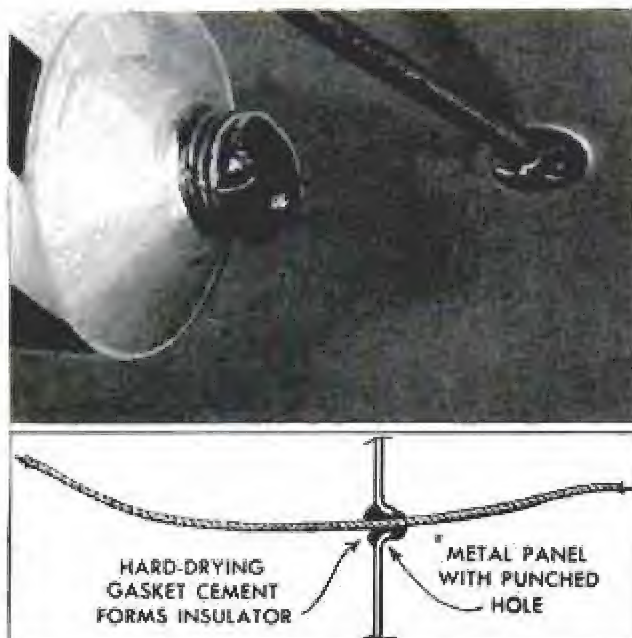
Altered Drill Chuck Allows Work to Pass Through Headstock



As a substitute for a collet chuck one machinist drilled an $1\frac{1}{32}$ -in. hole through the tapered drill-chuck adapter of his lathe to permit long rods to be passed through the lathe spindle for machining. This allows the rod to be gripped at any point along its entire length as indicated in the detail. A lathe drill chuck altered in this manner and mounted on a tapered adapter will take stock ranging in size from $\frac{1}{8}$ to $\frac{5}{16}$ -in. dia. The chuck adapter is especially useful in facing and cutting-off operations of small diameter round stock.—Harvey H. Adams, St. Louis, Mo.

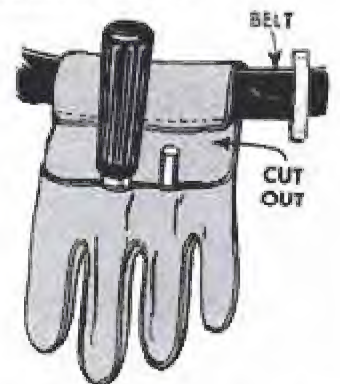
Pulley-Flange Repair

Large metal washers bolted to a V-belt pulley were used by one mechanic as an emergency repair to replace a broken section of the pulley flange. First, the broken edge of the flange was filed round and smooth. Then, holes were drilled in the pulley, located so that when the washers were bolted to the pulley the edge of the washers projected the same distance as the edge of the original flange. The additional weight of the washers was counterbalanced by other washers bolted to the opposite side of the pulley. As a further safety precaution, the power tool on which the pulley was used was run only at slow speed.



Toolholder Cut From Glove

A belt toolholder that will accommodate small tools, such as a screwdriver, file, nail set, pliers and punch, is cut from an old leather glove as shown. After the front half of the cuff is removed, the back is folded and stitched so that the holder can be slipped on a belt. The thumb can be left on the glove for short tools, or removed, as desired.

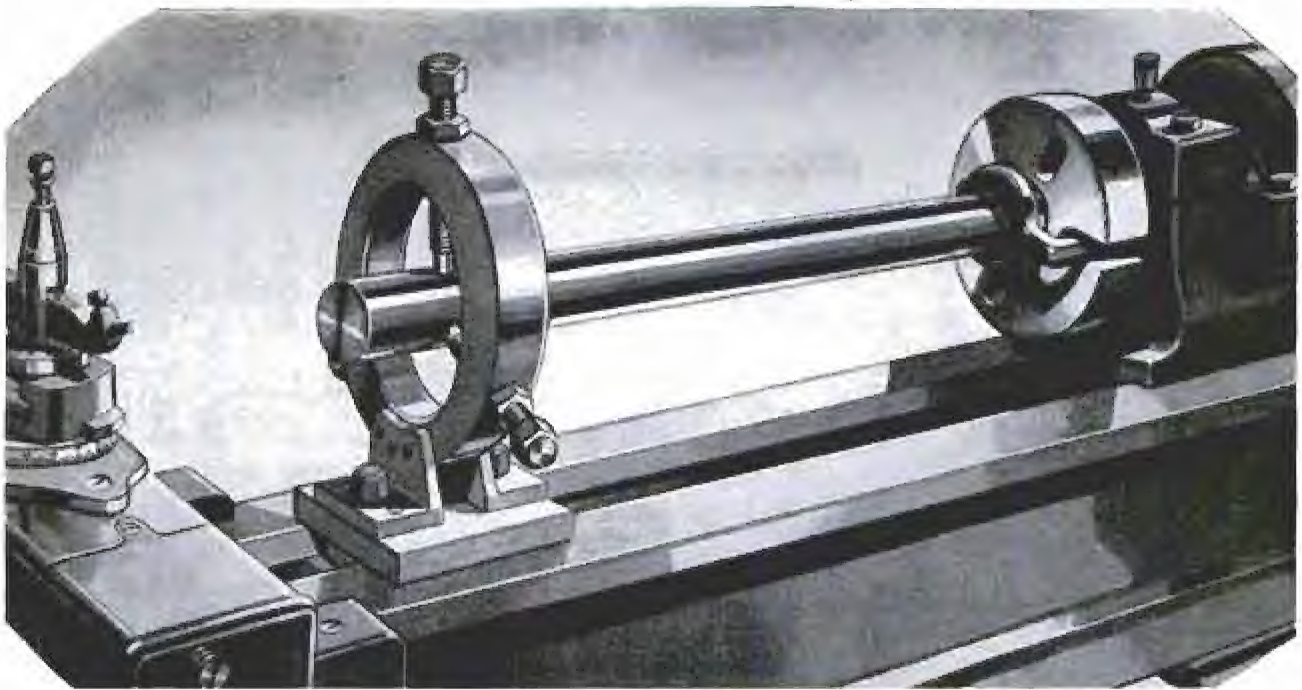


Frank Shore, New York City.

Gasket Cement Forms Insulators Around Wires in Car Body

Hard-setting gasket cement can be used to make insulators for wires that pass through sheet metal in automobile bodies. Holes are made with a center punch instead of a drill. Center-punching forms a hole with a smooth "collar" through which the wire is pulled. Gasket cement is applied to the wire at the point where it will pass through the hole. The wire is worked back and forth until cement forms an insulator.

Ⓒ Rusted chrome plating on auto parts and accessories can be polished to a like-new shine by wiping with a damp cloth, then buffing briskly with aluminum foil.



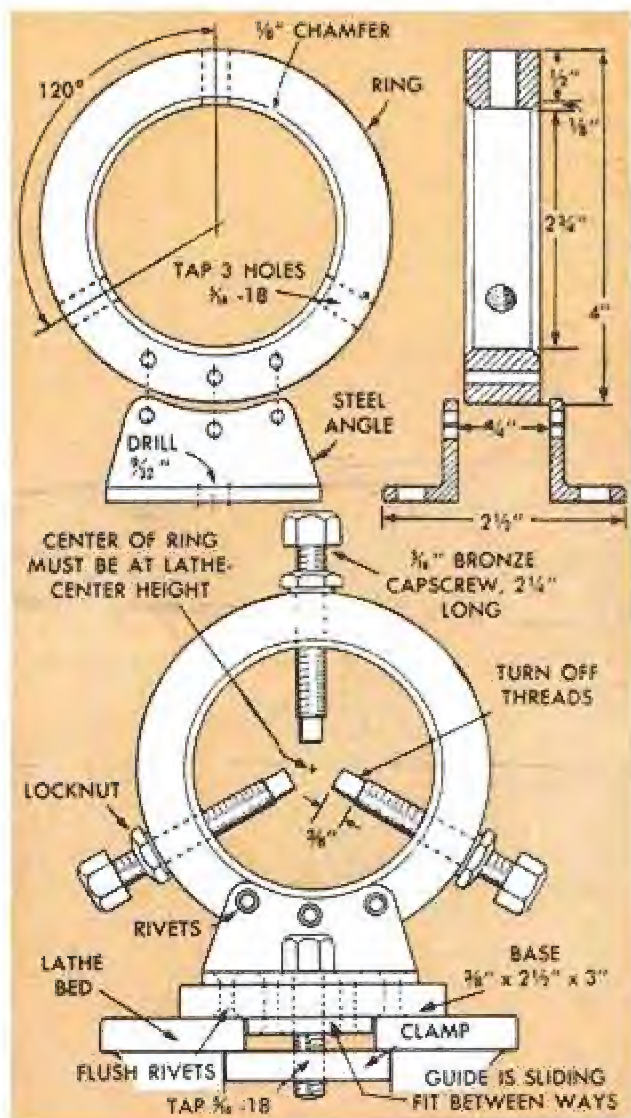
Steady Rest for Metal-Cutting Lathe

HOME CRAFTSMEN who own a small lathe will find this steady rest, made from cold-rolled steel scrap, a useful accessory for supporting long work during turning, boring or threading operations. The large ring can be made from heavy-walled tubing or bored and turned from $\frac{3}{4}$ -in. steel plate. Tap 3 holes $\frac{3}{16}$ -18, spaced 120 deg. apart, in the finished ring for bronze capscrews which serve as adjustable jaws. With the capscrews in the ring the latter is mounted and accurately centered on a mandrel held between centers on the lathe. This will support the ring with its center at lathe-center height so that its lower outline can be scribed on angle-iron brackets set up temporarily on the base. This must be done to locate the vertical position of the brackets to support the ring center at exactly lathe-center height. When the brackets are filed flush with the inside surface of the ring they can be clamped together with the ring and cross-drilled for three rivets as shown. The assembly then is clamped to the base member and guide and drilled for rivets to hold these parts together. To complete the project, a hole is drilled through the bracket, base, guide and clamp on each side of the ring for clamp screws.

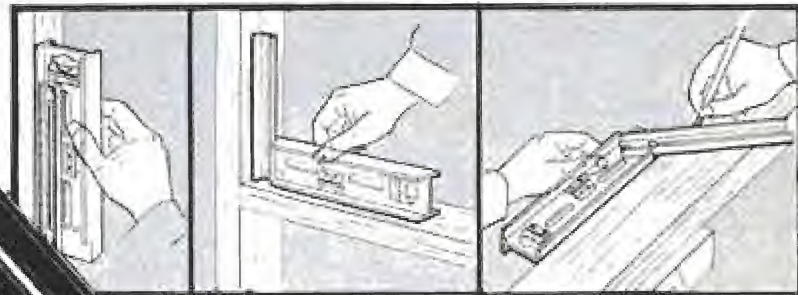
In the illustration, the setup is shown for machining unfinished stock, the left end of which must be held against the live center either with a rawhide lacing or by means of a special dog. The lacing has been omitted from the illustration for purposes of clarity. Finished stock can be mounted in a three-jaw chuck with the outer end supported in the steady rest.

C. W. Woodson, Chicago.

All parts of lathe steady rest detailed below are machined from cold-rolled steel, except capscrews



SHOPPING FOR TOOLS



COMBINATION TOOL consists of a level, T-bevel and square combined in one handy unit. Change is made from one tool to another by the simple adjustment of a wing nut. Adjustable arm, or blade, which slides in or out can be set at an angle as in the sketch at right. Comes with both level and plumb viols

Macklamburg-Duncan Co., Box 1107, Oklahoma City, Okla.

WOODWORKING UNIT utilizes a portable power saw for stationary operations such as crosscutting, ripping, beveling and mitering. Attachments for shaping, jointing, turning, drilling, sanding and mortising also are available. Table is 36 in. wide. Power unit is quickly detached for use as portable saw

Reamstown Products Co., Reamstown, Pa.



MASONRY DRILL is adjustable for drilling neat, round holes up to 5 1/4-in. dia. in building block, tile and plasterboard. Cutters are carbide-tipped for long life without resharpening. Comes with a small carbide-tipped drill bit for drilling the pilot hole. A 1/2-in. electric drill powers the unit to full capacity

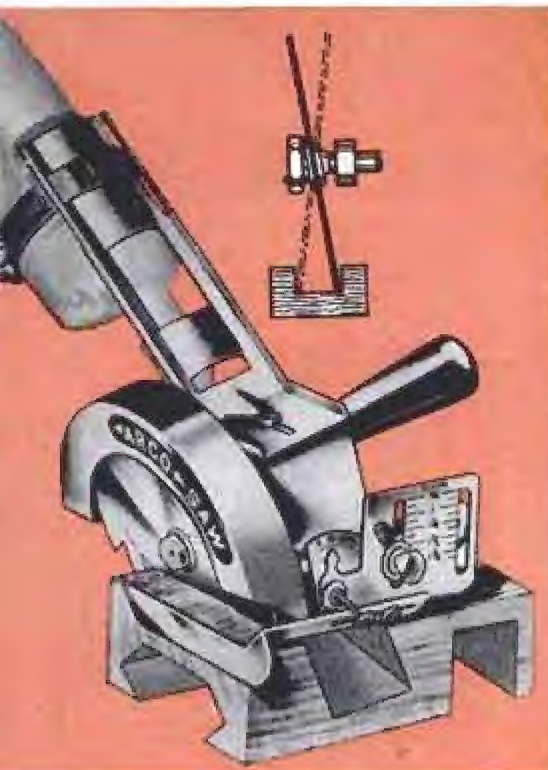
Randall & Reynolds Machine Co., Alpena, Mich.



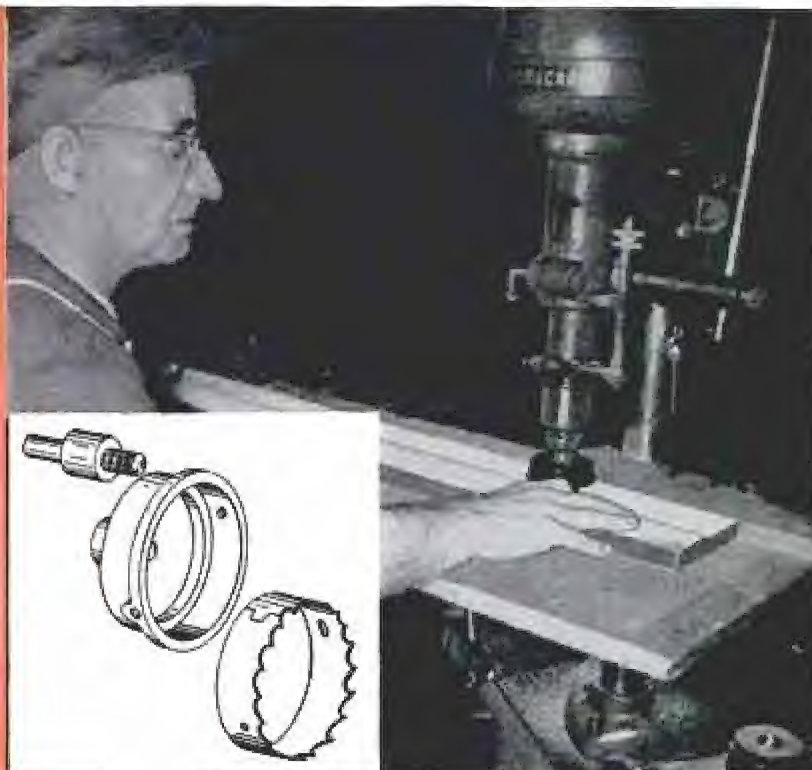
PIPE WRENCH is fitted with a Z-shaped spring bent to fit under a pin running transversely through wrench housing. Pin acts as a pivot, giving a more positive bite and release of the pipe jaws. Upper photo shows position of movable jaw when there is no pressure on handle. Lower photo shows jaw position when pressure is applied. When pressure is released, jaw assumes original position

Erie Tool Works, Erie, Pa.





WOBBLE-SAW ATTACHMENT for portable electric drill cuts grooves up to $\frac{1}{2}$ in. wide by 1 in. deep in one pass over the stock. Can also be used as a straight cutoff and rip saw by removing the wobble-saw arbor. Unit comes fitted with an adjustable ripping fence for cutting strips of stock to a uniform width. Arrow Metal Products Co., 140 W. Broadway, New York City 13



ROTARY PLANER HEAD for use with a drill press planes a smooth, true surface on either hard or soft wood without chatter marks when driven at speeds as low as 1800 r.p.m. This is possible due to special shape of the cutting teeth. Removes up to $\frac{1}{16}$ in. in one pass. Will also make light cuts on plastic. Winkelman & Spott, Inc., P.O. Box 98, Lincoln Park, N. J.

PORTABLE WELDER works on 115-v., 60-cycle, a.c. For continuous welding of light sheet metals it provides about 50 amps. The holder is angled for handy manipulation in partially fabricated units and is provided with a cool handle. Using $\frac{1}{16}$ and $\frac{1}{8}$ -in. rods it has a capacity to weld 16-ga. sheet metal.

Caulhorn Distributing Co.,
9990 Broadstreet, Detroit 4, Mich.

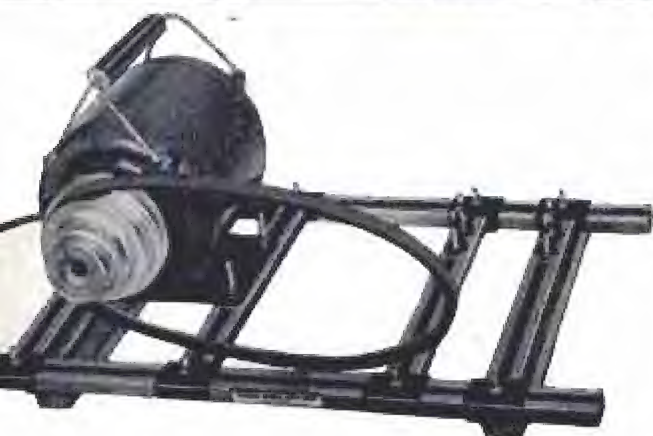


UNIVERSAL MOTOR MOUNT, lower left-hand photo, is especially designed for fractional-hp. motors and small gas engines. Adjustments provide for pulley alignment and adjusting for belt tension. Motor-driven appliances also can be bolted directly to the motor-mounting unit and pulleys properly aligned.

Arco Mfg. Co., P.O. Box 817, Grand Forks, N. D.

QUICK-ADJUSTING C-CLAMP is fitted with an elliptical nut which automatically releases, permitting threaded spindle to be rapidly adjusted to thickness of stock. A turn of handle clockwise engages nut. Once engaged, clamp can be tightened at any point along the length of spindle. Comes in 6 sizes.

Wilton Tool Mfg. Co., Inc.,
935 Irving Park Rd., Schiller Park, Ill.





On the MARKET

FOR THE DO-IT-YOURSELF



ADHESIVE FOR PLASTIC and metal wall tile, (above) can be worked four hours after application, remains plastic to absorb expansion and contraction of tiles
Midcontinent Adhesive Company, Grove City, Ohio

LOW-COST FLOORING (above) consists of $\frac{1}{8}$ -in. hardwood veneer glued to $\frac{5}{8}$ -in. softwood backing, which is grooved so it is flexible enough to follow slight irregularities when nailed to wood subfloor or set in mastic on concrete
U.S. Forest Products Laboratory, Madison, Wis.

BROKEN POT HANDLES and other metal objects around the home can be repaired without heat by using a plastic paste containing epoxy resin (right). Paste adheres firmly to metal and when dry can be drilled and worked like metal
Taylor and Art, Inc., 1210 E. 12th St., Oakland 6, Calif.



THERMOSTATIC WATER CONTROL adjusted by one dial (below) has safety limit to keep water below 110 deg. F. If cold-water supply fails, control shuts off water completely, assuring safety of children in shower or bathtub
The Powers Regulator Company, 2400 Oakton St., Skokie, Ill.

BLOND FINISH FOR FURNITURE originally stained dark is applied in paste form in two coats. After second coat is applied, special tool with flexible blades marks in wood "grain"
Frost Paint and Oil Corp., 1209 Northeast Tyler, Minneapolis 13, Minn.



BRAND NEW FROM KODAK:

Handiest filter kits ever designed!

Imagine the convenience of having all your basic filters visible, instantly available—yet *individually protected* in a rugged case small enough to tuck in your pocket or gadget bag!

That's what you get in a smart new Kodak Filter Kit. Each kit comes *complete* with the basic filters you'll be using the year around, plus an adapter ring (if your camera requires one). For color shots you have a Kodak Skylight Filter to cut down haze in distant scenes and a Kodak

Daylight Filter that lets you shoot indoor color film outdoors.

In addition, a Kodak Pictorial Filter is included in the still-camera kits to accent clouds in your black-and-white pictures, or a Kodak Portra Lens can be added for dramatic close-ups.

Ready-to-use Kodak Filter Kits for most still and movie cameras are priced from \$6—the *regular price* of the filters and lens attachments. *There's no extra charge for the case!*

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- Each filter visible, protected in its own compartment
- Convenient size for pocket or gadget bag
- Filter Kits are also available without adapter rings so that kits can be custom-made by your dealer to fit your particular camera.

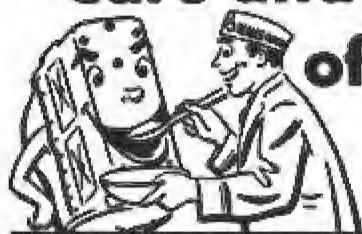
Prices are list, include Federal Tax, and are subject to change without notice.

Eastman Kodak Company
Rochester 4, N. Y.



Care and Feeding of Engines

BY
S. P. CORP

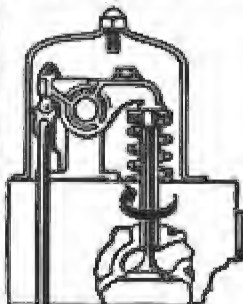


VALVE TAPPET ROTATION

Valve tappets should rotate on the cam lobes. This rotation is caused by a small degree of rake on the surface of the cam lobe of the camshaft, coming in contact with a convex surface on the tappet foot and moving it part of a turn each time the tappet is lifted. This insures long life for tappets.

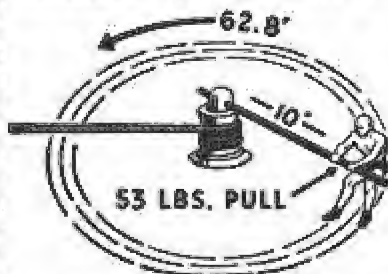
This rotation should be verified whenever valves are inspected. Failure to rotate means tappet may be dry in the guide, or a flat spot may be worn in the foot of the tappet. Check rotation when installing a new tappet or a new camshaft. If either tappet or cam lobe is worn, tappet may not rotate, causing wear and noise.

In L-head engines, tappet rotation promotes valve rotation, insuring a tight seal. In OHV engines it is important that valves rotate each time they open or close, to keep valve seat clean and minimize wear. If valves are not turning, look for a sticking condition in valve guides and check for correct valve adjustment. Lubricate valves around guides with penetrating oil.



TORQUE AND HORSEPOWER

Torque is twisting effort. If a man applied 53 pounds of torque on a 10-foot lever, moving over a 62.8-foot circumference in one minute, he would perform one-tenth of a horsepower of work. If he increased his speed to maketworevolutions a minute, he would exert twice as much horsepower, but the 53 pounds of torque would remain the same. When an engine has 218 foot-pounds of torque at 2000 R.P.M., that is simply a statement of pull at the end of shaft (or lever).



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Sealed Power

PISTON RINGS

Clinic for Homemakers



As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Rose Feeding

Q—I'm a rose fancier, have grown several varieties for some years, but I'm still not satisfied with the quality of blooms I'm able to produce. I've always used plant-food mixtures containing natural organic materials, never the chemical fertilizers which I'm told have a higher rate of availability of plant nutrients. Can I change to chemical fertilizers without damaging the established plants?

—R. T., Ark.

A—In general, yes. But it should be remembered that production of top-ranking blooms is not due merely to the kind of fertilizer used. Cultural methods, soils, the growing season and many other factors that influence growth play a part in determining the results. One of the main problems in the use of supplemental fertilizers in rose culture has been to obtain a combination of organic materials that would release nitrogen slowly and at a continuing rate sufficient to support a vigorous growth during the season. In a general way this has been achieved by the use of organic materials such as cottonseed meal, bone meal and tankage which maintain a fairly uniform plant-food release rate. However, on well-drained soils the complete chemical fertilizers seem to produce equally good results, assuming that other conditions are favorable. A new complete chemical fertilizer especially compounded for rose culture is soon to be available. It is said to contain nitrogen in four different forms of varying rates of availability, also two sources of potash and phosphorus.



Natural Finish

Q—The siding on my new home is finished in the natural color. At first it was a very beautiful blending of reds and browns, but within six months it began to darken and now what was once brown is almost black. The lower edges of some of the boards are beginning to turn gray. What causes this change and how can I restore the color?—O. G., Ore.



(Continued to page 224)

MEN WITH MECHANICAL SKILLS:



CAN YOU MEET THIS CHALLENGE?



Mechanics Creed

Upon my honor I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I believe to be beyond the limits of my knowledge; nor shall I allow any superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a certified mechanic to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.

If you are a man who takes real pride in a job well done, the Air Force offers you a challenging and rewarding career. The safety of our country, and the lives of its defenders, depend on your accuracy and devotion to duty. Act today and put your skills to work tomorrow—in the U. S. Air Force.

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M-40-PM2

Airman Recruiting Information Branch
Box 2202
Wright-Patterson AFB, Ohio

Please send more information on my opportunities for enlisting in the U. S. Air Force. I am between the ages of 17-34 and reside in U.S.A. or possessions.

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Address _____ Age _____

City _____ Zone _____ State _____

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this display!*

at Hardware and
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Pressure-sensitive masking, strapping, freezer and many other tapes. Sandpaper, abrasive cloth and sharpening stones for home and industry.

(Continued from page 222)

A—You cannot restore the original color of the wood without scraping the surface sufficiently to expose new wood. Neither can you "hold" the original new-wood color with any ordinary transparent finish. Even the application of the finish itself will immediately darken the wood somewhat due to the change in reflective properties at the surface. The most commonly used siding woods are cypress, redwood, western red cedar and white pine. The reds and browns in these woods tend to intensify, that is, darken on exposure to rain, wind and sun. After a time the wood turns a grayish color, especially where the exposure is greatest as on the east, west and south sides of the structure. There are several clear finishes now available which are especially compounded for use on siding. These are said to be quite effective. However, the protective coating must be renewed at least once a year, and sometimes more often on those areas where exposure is greatest. Some of these finishes contain a small amount of pigment for greater protection against weathering. However, this is not sufficient to hide the grain of the wood. Judging from your description of the condition of the siding on your own home, the best procedure would be to sand the surface lightly and then apply one or two coats of a new finish containing pigment. This will not lighten the wood, but it should help to preserve whatever there is remaining of the original new-wood color. We hesitate to suggest that you scrape the surface simply because of the amount of labor and time involved. However, if you wish, you might try using a portable power sander of the belt type.



Power Sander

Q—I have a home workshop equipped with a few power tools and now I'd like to purchase a power sander. I want a tool suitable for all-around work, one with which I can turn out a professional job of sanding ready for finishing on cabinets and home built-ins, also hardwood floors on occasion. I want a small, inexpensive portable type. What machine will fill my requirements?—M. H., Tex.

A—Except for sanding floors, a portable belt sander probably would be the best selection. We could not recommend a belt sander of the portable type for floor sanding due to the time required to cover an appreciable area effectively. It is better to rent a floor sander from your local hardware or paint dealer for this purpose. For rough-sanding and finish-sanding on cabinets, or any flat surface of limited area, a portable belt sander will come the nearest to filling your requirement for an all-around machine. By using belts of various grit sizes ranging from coarse to fine you can do a professional job on either hard or soft wood. Portable belt sanders with coarse-grit belts cut very fast on unfinished wood. For this reason use care when sanding plywoods as you may cut through the face veneer. When sanding veneered stock it's best to use a medium or fine-grit belt. Machines taking belts 3 in. wide are perhaps best for general use.

Removing Stains From Linoleum

Q—My kitchen-cabinet tops are red linoleum. There are several stains in the form of rings on one cabinet top. I don't know what has caused them. Is there any way to remove the stains?—T. E., Calif.

A—You might try going over the area lightly with fine steel wool, then wash thoroughly with mild soap and water and allow to dry. Stains that have not penetrated too deeply usually can be removed entirely in this manner or at least so greatly reduced that they are no longer noticeable. Sometimes it will help to apply raw linseed oil to the areas after washing. Allow plenty of time for drying, then rub in the oil with a soft cloth.

Glidden Announces . . .

New GLID-TONE products specially made for do-it-yourself wood finishing

Now Glidden takes the "mystery" out of wood finishing, staining. The new array of Glid-Tone products have "built-in" features for amateur use; give *professional results*. Look for the Glid-Tone label at your paint store.

New, easy-to-use stains in color! Use *Glid-Tone Stains* either inside or out. Seals, does not raise grain. Extremely easy to use—just wipe or brush on, wipe off!

For high gloss and highest resistance to alcohol, acid, heat and abrasion, use all-purpose *Glid-Tone Gloss Varnish* . . . for floors, furniture, table tops, bars, cabinets!

For exterior trim, paneling, boats and marine uses—*Glid-Tone Spar Varnish* is extremely tough, withstands effects of water, salt spray, heat, sun, cold.

For modern, hand-rubbed effects without laborious rubbing, use *Glid-Tone Satin Sheen Varnish*. Self-priming. No thinners or other extras required. *

Glid-Strip—a safe, effective paint and varnish remover. Lets you work larger areas because it stays wet longer. Non-flammable. Cleans up with water!

Glid-Tone Natural Wood Filler—for filling open-grained woods . . . oak, chestnut, walnut, mahogany, pine, fir, redwood.

Glid-Tone Crystalac—an all-purpose, crystal-clear brushing lacquer coat for beautifully grained light woods. Dries in only 20 minutes, provides lasting protection. Non-yellowing.



Unfinished Furniture

Furniture Refinishing



Interior and Exterior Paneling

Floors



Pleasure Boats

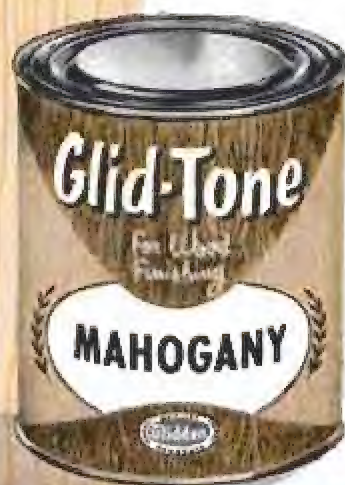
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Write for Glidden Service Sheet PM-5 . . . complete wood finishing directions!

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Send for plans



Your girl will love this 2-bedroom Cape Cod doll house. It's 23" x 17" with slotted construction so it can be packed away in its own base-storage chest. Roof swings up, front removable for access to all rooms. Full size pattern. Easi-Bild plans just 50c.

Build this colorful, 4' x 5½' PlayHouse-PlayStore, too. Even a beginner can do the job with Easi-Bild pattern directions and plans. Sturdy PlayHouse-PlayStore has shelves, room for furniture, door and window, plus clever cut-out trim. Plans—60c.



Both projects made with rugged 3/16" Upson fiber board, the easy-to-work board that makes any home project a cinch to build. 3/16" Upson saws easily, is light in weight, yet is strong and durable. Edges sand smooth. Paints and finishes beautifully.

All Upson fiber board sizes and types are available at your nearby lumber dealer's. Use 3/16" indoors, 3/8" All Weather outdoors.

Send today for your Easi-Bild Patterns. Included: complete directions, step-by-step pictures and material list. Enclose 50c for Doll House, 60c for PlayHouse-PlayStore. *Mail coupon today!*

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Send free details on _____

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Eyes Over the Ocean

(Continued from page 139)

continues to use celestial observations, radar ranges or bearings and radio-direction-finder bearings when he can obtain them. But loran signals, according to the Coast Guard, are correct 99.7 percent of the time. When the scope watchers in a loran station find an error in synchronization, they switch to a blinking signal that warns loran users to disregard the signals. In a moment a stand-by transmitter takes over.

At Sandy Hook, near the entrance to New York Harbor, technicians have installed an "automatic" station that needs no scope-monitoring teams. If this type of system proves effective, the Coast Guard will have found a way to reduce drastically the personnel assigned to the monotonous work of the lonely loran outposts.

Loran Rescue

Loran has more than once saved a life. One stormy January night the fishing boat *Student Prince II* lay foundering at a point 200 miles north-northeast of Bermuda. Her seams ripped open, her lifeboat smashed in a futile attempt to abandon ship, she was sinking rapidly with 10 men aboard. The outbound *Queen of Bermuda*, 150 miles away, heard her distress call. Time was precious. Fortunately, the *Student Prince* was equipped with loran, as was the *Queen*. She radioed her loran readings to the *Queen*, which was able to speed in a direct line to the ailing vessel, to reach her in seven hours. Two hours after the crew was removed the ship sank.

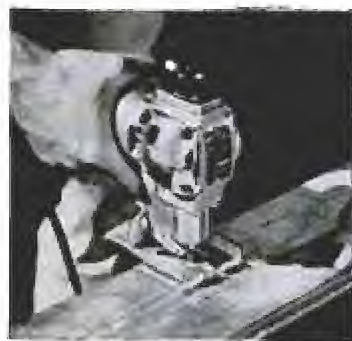
The precise location-finding help that enables a ship or tug to speed to the rescue of a stricken ship aids a fisherman in getting bigger catches. Almost all of the Gloucester fishing fleet is equipped with loran sets, many of them sold for surplus after the war. A trawler captain reports that loran saves 10 hours on each trip. He finds that he can get on top of a favorite fishing spot and start dragging right away. If a storm comes up, and he has to head for port, he can resume operations immediately after the storm subsides.

Sometimes the fishing boats heading home can get on a loran line that intersects their home port. It's then a simple matter to speed home on the "loran highway."

In the Bering Sea, where fog and stormy weather make fishing hard work, the trawler *Deep Sea*, fishing for king crabs, "prospects" along loran lines of position. Once, the *Deep Sea* marked a favorite fishing spot with a buoy. When the ship returned to the area later, the buoy had sunk. The skipper

(Continued to page 228)

The only heavy-duty jig saw on the market able to cut bevels up to 45° angle . . . on either side!



BUILDERS



ELECTRICIANS



PLUMBERS

New *Black & Decker*® Heavy-Duty Jig Saw lets you:

- ★ Cut bevels to 45° . . . either side!
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This versatile new B&D Heavy-Duty Jig Saw does *more* than you've ever seen a jig saw do! Runs cooler, even sawing 2 x 4's—powered by a custom-built B&D motor! Notice that *bevel-cutting* feature—think how that will help you

on your job! Makes pocket cuts, too. Full 1-inch stroke for greater speed. See your B&D dealer *today*, or write to: THE **ONLY** BLACK & DECKER MFG. Co., **\$120⁰⁰** Dept. M-56, Towson 4, Md.



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This U-10 is designed for lighter jobs and priced still lower! Ideal for average home and light maintenance jobs . . . this wonderful B&D Jig Saw is perfect for cutting intricate patterns! Saves hours of hard work on projects, opens new workshop horizons. Make shelves, tables, outdoor furniture! **ONLY \$54⁵⁰**

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estimated the position with loran. Later, when the nets were hauled up, the sunken buoy and its anchor were found in the net.

"In eight months we doubled our take of king crab with loran," says Lowell Wakefield, captain of the *Deep Sea*.

Loran is even more profitable for Western Union Telegraph's cable ship, the *Cyrus Field*. In certain areas where much repair work is necessary, fog formerly prevented celestial "fixes" and kept the ship in port for as long as 10 days at a time. The ship costs \$2000 a day to operate. With loran, such \$20,000 delays are eliminated.

Skippers traveling along the Atlantic coast have long tried to take advantage of the Gulf Stream. Going north, they can gain extra speed by riding the current. Going south, they try to avoid it. But it has always been difficult to follow the course of the meandering stream. Now, many oil companies have equipped their entire fleets with loran. The SS *Bulkfuel* reports that it saves four hours per voyage by using loran. Other ships report greater savings.

Almost all the big passenger liners and transoceanic aircraft are now equipped with loran, as are all U.S. Navy combat ships, planes and auxiliary vessels. Merchant ships and even pleasure yachts are using the electronic navigational system.

Other Position Finders

Loran supplements and does not directly compete with the many other forms of navigational aids. Loran has a range of 700 to 900 miles by day and up to 1400 miles by night, when sky waves from the station bounce off the ionosphere and are reflected the greater distance. Decca, a British position-finding device, is limited to 600 miles by day and 300 by night. Shoran is a short-range United States system. Tacan, likewise, is short range. Consol, a long-range beam system in common use because any radio picks up the signals, is not as accurate as loran.

Loran is not affected by other electronic equipment on board, and is not put out of order by magnetic storms.

The loran receiver, which is basically a superheterodyne radio receiver on which signals are seen rather than heard, is connected to a 25 to 30-foot whip antenna by coaxial cable.

Tested and proved, the loran receiver has reached a state of perfection which makes it a standard instrument on ship or plane. A model now in experimental use gives a continuous reading as the craft carrying it moves across the earth.

When jet airliners streak from New York to Paris in six hours, the set will prove a vital tool in keeping them on course. ★★

1956 CHEVROLET

The safety story behind horsepower that ranges up to 225!

by **ED COLE**, *Chevrolet Chief Engineer*

Lately, it seems, all my friends are asking me about higher horsepower ratings. "Two hundred and twenty-five horsepower means just that much more speed, doesn't it?" many of them ask. I tell them that top speed isn't the point at all—that higher horsepower in the '56 Chevrolet means better acceleration, response and maneuverability. It means the car is *safer to drive!*

For instance, Chevrolet's new horsepower, ranging up to 225, gives you a split-second punch of acceleration that can whisk you out of a potential accident situation in a jiffy. That same burst of acceleration from a stop can put you in motion in the blink of an eye when you want to get away fast. Chevy's higher horsepower means safer passing, too. You can get around a car more quickly and back into your own lane. It means more power for safer hill climbing and more power in reserve at all times.

That big-bore V8 of ours *does* have more power. Up to 45 more horsepower than last year! The compression ratio's been boosted as high as 9.25 to 1 for an even greater high-compression power punch. But that power is put there for your pleasure and safety and I'd like to suggest this: See your Chevrolet dealer and road test one of our new Chevrolets. See if you don't agree that it gives you a new margin of safety on the road! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

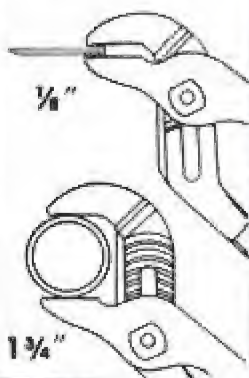


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BE SURE IT'S A GENUINE CHANNELLOCK



CHAMPION DEARMENT TOOL CO. MEADVILLE, PA.

Citroen Springs Some Surprises

(Continued from page 145)

radiator, making the trunk almost as deep and roomy as the hold in a ship. The gasoline tank is located under the rear-seat cushion so the 17-cubic-foot trunk looks bottomless.

Frenchmen (and other Europeans) are not anxious for automatic transmissions—gasoline costs are too high. They want miles per gallon, especially in city driving. Citroen has the next best thing to an automatic transmission, an effortless four-speed shift. There is no clutch pedal. Clutch operation is automatic. When you move the shift lever, the clutch automatically operates. Gear shifting is power assisted so that all the driver does is move a valve and the hydraulic pressure slides the gears. This eliminates linkage problems and cuts time lag to zero. But that's not all: A modulator controlled by the accelerator varies the speed of the engagement so it engages fast when you want a "jump" start or slowly when you want to ease away without a jerk. The clutch automatically disengages when the car comes to a stop.

While the DS 19 is all new (the only part of the old car retained is the cylinder block), it still has the Citroen characteristic of putting the wheels on the corners which makes it one of the world's most roadable cars. But that means no rear overhang—as one viewer said "It has no tail!" Many devotees of the current "emphatic tail" school of styling criticize this, but the short overhang does make it amazingly maneuverable and, perhaps more important in France where the bigger the car the more it costs to park, the short overhang puts it in a lower parking-rate bracket!

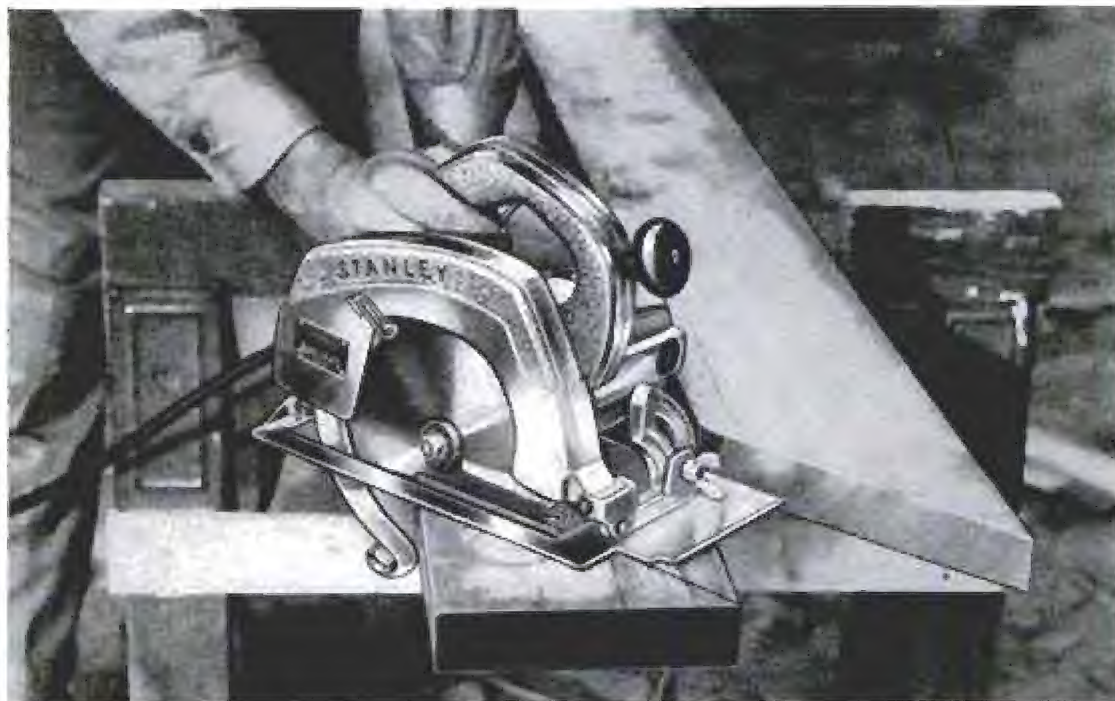
The roof of the DS 19 is plastic and for those who like to look up as they drive, it is available transparent. Directional signals are mounted high along the roof line at the rear so there is no excuse for the following driver not to see them.

What about the engine? It is a small, economical four-cylinder with hemispherical combustion chambers. Its cylinder head is aluminum. Valves are overhead, being mounted at a 60-degree angle. Horsepower is 75 at 4500 revolutions per minute. Displacement is 1911 cubic centimeters (hence the 19 in DS 19) or 116.57 cubic inches, making it about half as big as a Ford six-cylinder engine.

Top speed is 90 miles per hour, by factory guarantee. It cruises at about 72 miles per hour. It will average more than 20 miles to the gallon over-all. The car weighs 2947 pounds.

(Continued to page 232)

new saws that DO MORE and COST LESS



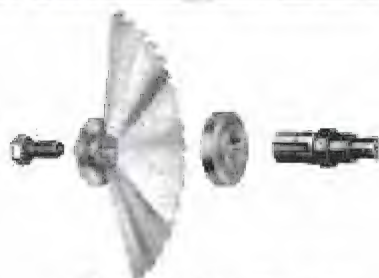
Whether you prefer a 6", 7" or 8" saw, Stanley makes them all . . . and all for heavy duty. Now at reduced prices.

6" H65 cuts 2" at 90° — 1½" at 45° and retails at \$59.95.

7" H70 at \$69.95 cuts 2¾" at 90° — 1¾" at 45°.

8" H85 at \$79.95 cuts 2¾" at 90° — 2¼" at 45°.

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The "Motor Saver"
Power plus protection!

Exclusive Stanley drive protects saw motor against impact shock when blade hits nails, etc., and ensures full cutting power at all other times.

Featuring . . .



The "Free-Start" Guard
Ease of operation!

Exclusive Stanley blade guard makes starting cuts accurate and easy. Guard never sticks regardless of angle of cut . . . no "hang-up" or "drift" in starting.

Look for these fine saws. Your dealer can supply you or obtain them promptly for you. For free power tool catalog No. 400, write Stanley Electric Tools, 625 Myrtle St., New Britain, Conn.



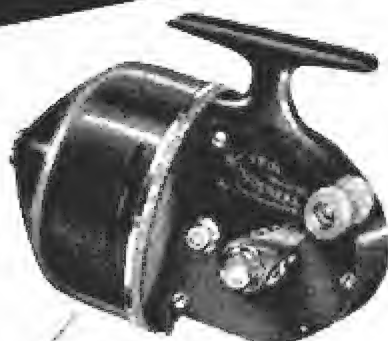
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crank model, factory-filled with 150 yards new, extra-limp 6-lb. test Tynex **\$17.95** monofilament line

(Other models from \$13.50 to \$28.50.)

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Here are some additional items of interest about the DS 19:

- It has a flexible nylon engine fan that consists of eight very short blades.

- It has a control on the dashboard that lets you disengage the automatic clutch so the car can be left in gear on an incline. Incidentally, the DS 19, despite its modern design, still provides a hand crank.

- The steering wheel is spokeless. The steering column is bent and flattened to support the rim and sticks out of the dashboard like the tongue on a cow. This design gives excellent instrument vision and has a safe cushioning effect in a crash.

- Rear fenders are removed by loosening one bolt. Front fenders come off when three bolts are removed.

- Seats recline to form a bed.

- There are no pivoted vent windows in the front doors. Instead, air enters through a grille at each end of the dashboard, eliminating the wind noise inevitable with usual no-draft systems. Deflectors on the grille let you direct the incoming air in any direction.

- Tire changing involves removing only one central nut instead of the usual five lugs.

- Every power-assist feature is backed up by a mechanical system for safety. Should the whole hydraulic system go out, the car can be driven safely to the garage. Even windshield wipers can be hand operated if the electric motor fails (this, by the way, is required by French law).

- The braking system is double—a separate master cylinder and tubing for the front brakes and another independent circuit and master cylinder for the rear brakes. Thus if one system fails, the other still operates.

- In typical French fashion, the DS 19 comes with a ladies' hand mirror tucked in a pocket inside the glove compartment!

Is it selling? Well, the factory is 28 months behind on its orders for French delivery. Americans are luckier. They can get one delivered here in only a few months. The price? It sells for \$3285 in New York City, complete with all accessories. ★ ★ ★

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Research now indicates that frozen blood can be stored indefinitely in liquid nitrogen. The freezing, done fast enough to prevent ice crystals from forming, is accomplished by spraying the blood through a fine plastic tube onto the surface of the liquid nitrogen. When needed, the liquid blood is reconstituted by sprinkling the frozen droplets into a warm salt solution or plasma.

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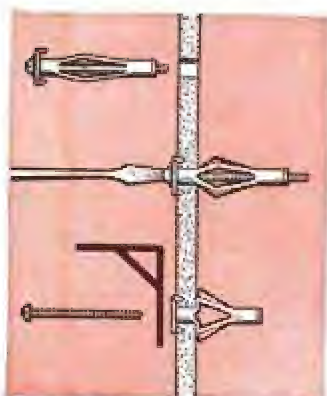
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Electric Farm Hands

(Continued from page 153)

pulled and there would be consternation and confusion. Well, that hasn't exactly happened, but when the molasses blower was first installed, too much pressure was applied and molasses shot over floors, walls and men. It was like a scene out of an old Mack Sennett comedy film. But the brothers figure they quickly paid for the cost of new overalls and jackets with their mixing equipment.

While we were on the Meyers place, 1000 head of lambs were put on the scales prior to shipping. Fifty days earlier those lambs had weighed in at an average of 84 pounds. We watched the scales balance again—this time to show an average weight of 112 pounds. That meant a gain of more than a half pound a day.

Sight of a shovel always gets the Meyers brothers to thinking. A man using a shovel represents only $\frac{1}{10}$ horsepower. In 10 hours, the man can do only one horsepower of work. At Idaho rates, electricity will do one horsepower of work for about one cent. Thus, for a cent a day electricity provides the farmer with the equivalent of a shovel-wielding hired man.

Shovel Gives Way to Electricity

The Meyers figured they could profitably substitute electrical power for the hand-shoveling of whole grain into the barn for storage. This is the result of that figuring:

Bulk grain is hauled to the barn entranceway in a truck. The load is emptied into a specially constructed bin that tapers down in the center to a pipe. A $7\frac{1}{2}$ -horsepower motor then blows the grain through the pipe that is shifted from place to place in the barn by the tug of a rope.

To get the grain out of the barn, an electrically operated worm is used. It functions on the same principle as a furnace coal stoker. Mounted on wheels, it can be moved to any part of the barn to pick up grain and pour it back into a dump truck.

Still without a shovel being used, the truck backs up to a basement bin in a mixing shed, and empties its load. The electrical mixing equipment carries on from there.

No hand operation on the place is too minor, either, for the Meyers brothers to consider rigging up a motor to do the job better. Deciding that hand-pumping of gasoline for their vehicles was too slow, they attached a $\frac{1}{2}$ -horsepower motor to a couple of dollars' worth of pipe on their gasoline tank, and now they have a service station in miniature.

(Continued to page 236)

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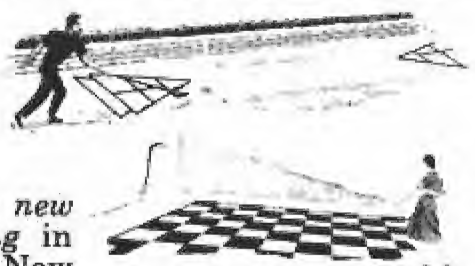
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Something new and exciting in decorating! Now

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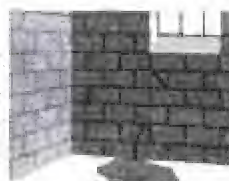
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Then there are six automatic cattle waterers. With each unit containing two 300-watt heaters, the water is warmed enough during the winter to prevent freezing.

The brothers are continually thinking about adding more electrical equipment—if they are convinced it will do the job more efficiently. Matter of fact, they are interested in electrical ideas still unborn.

Marvin serves on the University of Idaho's Farm Electrification Research Committee. This is a committee composed of farmers and power representatives who are advisors to the university's researchers on farm-electrification needs. This program has helped bring electricity to more than 95 percent of the state's farms.

"But the Meyers farm, with its many and varied electric timesavers, is in a class by itself," commented Prof. J. W. Martin, head of agricultural engineering at the University of Idaho. "The Meyers brothers also started right by installing adequate wiring, and they got experts to do it. This isn't true on many farms. The Meyers have followed the principle that you need large wires to carry heavy electrical loads just as you need large and adequate pipes to carry a lot of water."

Farm Was Run-Down

When the brothers bought the farm in 1944, it was about the most run-down place in the county. The land had been milked almost dry . . . it was rolling and hard to irrigate . . . weedy . . . 100 of the 400 acres were absolute waste . . . sloughs with willows and cattails. . . .

"Good for ducks," snorted Wayne Meyers. "But we bought it."

Why? Well, Marvin and Wayne, along with three other brothers and two sisters, had been raised on 100 acres just across the road—land to which their father, Charles, had come in 1911, and leveled and nourished and irrigated the hard way. It is good land now, and Marvin and Wayne figured there was fundamentally no difference in the land just across the road. But the land had to be put in profit-producing shape fast.

Using a 12-yard scraper and a 40-foot leveler, pulled by big "Cats," the brothers tore into the 400 acres. Not only did they make the land almost as level as a bowling alley, but they carved out new and bigger fields.

"Too often old fence rows are followed by one generation after another," said Marvin. "Fields were originally cut out for operation with smaller and more primitive equipment. We figure the best economy is to make the fields big enough so they can be worked with big equipment."

(Continued to page 238)

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But once the brothers had leveled the land for efficient subirrigation, the topsoil was gone. Now, the Meyers had been watching Californians come into southern Idaho and buy stock and feed, ship both to California, and fatten the stock at a profit. Why couldn't they do the same, and leave the fertilizer on their 400 acres?

"Natural droppings, we figure, are worth twice as much to the land as those hauled out in a manure spreader," said Wayne. "We felt that if we would only break even on a stock-feeding business we would profit through the land with our hay, grain, sugar beets and potatoes."

But the profit has been there from both stock and land. There is no question about that when you know how the Meyers operate. As a general rule, the brothers buy no new equipment until they have earned the money. They have a lot of equipment.

But the Meyers say they could never have accomplished so much so soon with the tools available a half century ago. They needed their modern, scientific equipment, particularly that connected with a canyon dam.

With all their equipment now, the Meyers simply do not have any labor problem.

"Taking a few of the backaches out of farming has eliminated a big labor turnover," said Wayne. "The men get the same thrill out of working with good and efficient equipment as we do. When an electric blower starts acting up, they tell us right away or fix it themselves, but they wouldn't do the same thing for a creaking wagon wheel."

Irving Spillman, a hired man, used to punch cows over Camas way.

"Looks good in the movies," he said, "but I'd a darned sight rather ride herd on a lot of electrical equipment." ★ ★ ★

Oxygen Inhaler

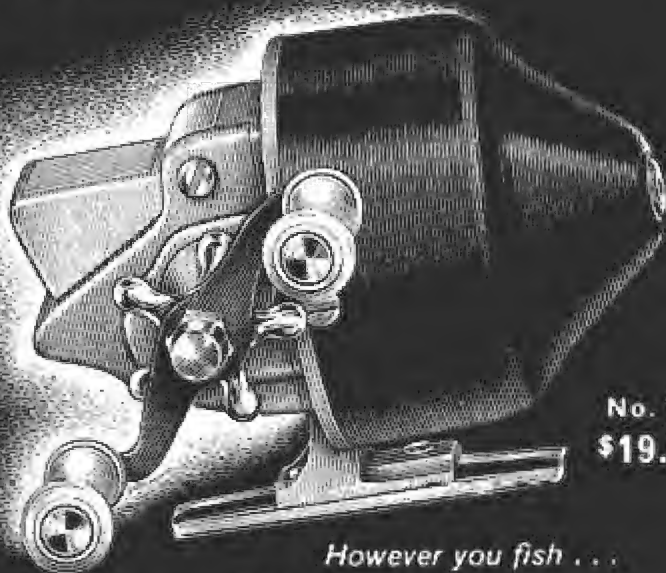


People who occasionally require respiratory stimulation can get it from a tiny oxygen inhaler about the size of a fat fountain pen. Scheduled for early production, it has a plastic tip that fits the nostrils, a small reducing valve, a drawn-aluminum

case and a replaceable cartridge that holds oxygen at about 5000 pounds' pressure. It dispenses the oxygen when a small valve is pressed.

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Traffic Jam at the Water's Edge

(Continued from page 109)

fun afloat. But a special preoccupation nowadays is the breaking of the water's-edge traffic jam.

Until not so long ago, these efforts were pretty much on an every-man-his-own-naval-architect basis. Within recent months help has come from national boating organizations in the form of basic planning material and from manufacturers in the form of prefabricated facilities and components.

The simplest launching ramp, OBC points out, is a ready-made one—a beach that extends underwater at a gradual slope to allow a trailer-borne boat to be backed up until it begins to float.

Next in order of simplicity is a slope formed by cutting down a bank with a road grader—or pick and shovel. Since trailers are not designed to operate in deep mud, a desired improvement is the surfacing of the slope with gravel.

A hard-surfacing technique that has found favor with city park officials employs precast concrete blocks.

Floating Ramps

Where there is a considerable and periodic variation in the water level, as in tidewater areas, the fluctuation must be compensated for in the design of the ramp. A ramp hinged at the shoreside and having floats at the waterside is the answer.

At locations that are bulkheaded and where space is limited, launching can often be handled best by means of a derrick or a monorail, which lifts the boat from the dock or pier and lowers it into the water.

Some clubs build wooden docks or piers. But steel and wood-and-steel combinations offered by manufacturers in ready-to-install form have taken practically all the work out of putting in facilities of this kind. In one version, the supports are driven into the harbor bottom with a sledge hammer; in another, the support ends are fitted with auger devices which screw into the bottom.

The ultimate in accommodations for the owner of a small boat is a "marina."

Marina will not be found in many dictionaries. It's a coined word and, so far as facilities for the boater are concerned, it can mean just about what the operator of the marina wants it to mean. In OBC's booklet on the subject, a "model marina" is described as consisting of these essential elements: Docks, boat slips, fueling units, a launching ramp, derrick and monorail launching devices, boat and trailer parking areas, sales and service accommodations, boat lockers and a restaurant and snack

(Continued to page 242)

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Dept. E667 Jefferson City, Missouri

bar. In short, a marina is an establishment where a boater can fill nearly his every need—buying boating equipment, launching and hauling out or storing his boat, servicing and fueling his rig, provisioning himself and his crew.

Most marinas are established as commercial enterprises, although some are run by clubs or in cooperation with clubs.

All these efforts by today's new yachtsmen, their "yacht clubs" and the boating trade will result in improvements in the lot of the boater and an easing of the nautical traffic jam eventually. But it will take considerable doing just to catch up and keep caught up—especially if, as seems likely, outboarding continues its recent expansion rate, which has been a five-fold one in 15 years. ★ ★ ★

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Seventeen ounces is the weight of a portable unit that can be used anywhere as a resuscitator or to give anesthesia. It can be used in mines, at swimming resorts and on the battlefield to revive persons overcome by near-drowning or smoke. In hospitals, it can be employed to give preliminary anesthesia to children who might be frightened by large operating-room machines, or to prepare patients for minor operations.



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Hold the D-23—and you'll *feel* the difference in its fine balance. Sight down its edge—and you'll *see* the difference in its accurately set and bevel-filed teeth. Bend it—and you'll hear the difference in the "twong"

of the double-taper ground blade of perfectly-tempered steel. Then use the D-23—and enjoy the extra satisfaction that comes with using a fine tool.

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The Atom Strikes a Valley

(Continued from page 86)

roads were built into the plant. Altogether the roads alone cost almost \$25,000,000."

Other facilities threatened to break down. Waverly's sewerage system definitely was not geared to the atomic age. The town got a federal grant of \$598,300 for a new sewerage system and voted a bond issue of \$600,000 to enlarge the city's water system. Piketon had similar crises. Chain stores, bowling alleys and drive-in theaters sprang up in cow pastures. Yet the merry-go-round never seemed to slow down or stop. Every new housing development, every mile of highway, every improvement to a sewerage or water system meant more construction work, bringing more workers into the area and burdening the existing facilities even further.

Big Payroll

Few long-time residents of the area were complaining, though. In the record months of 1954 an extra \$10,000,000 flowed into the economy of the area *each month*. Fifty and hundred-dollar bills were a common sight. Many a merchant who had been struggling along with his back to the wall suddenly found himself expanding that wall.

No sooner did the pinch appear in the Portsmouth area than it was compounded on both sides by two other vast construction projects. The process of gaseous diffusion requires enormous amounts of electricity. The government contracted with 15 private utility companies to do the job. They banded together, forming two new companies to build and operate generating plants at Cheshire, Ohio, and Madison, Ind. These are the two largest steam power plants ever built. The one at Madison alone cost \$185,000,000, three times the cost of the Empire State Building. Together they provide an incredible 1,800,000 kilowatts 'round the clock, a total of 15,000,000,000 kilowatt-hours annually, or more energy than is consumed by the states of Indiana and Kentucky combined. This tremendous surge of power is three percent of the nation's total supply!

There was a critical race to deliver this power by the time it was needed at the gaseous-diffusion plant. Thousands of workers were needed at these two construction sites. Land speculators who had lost out in the Portsmouth shuffle raced for the two generating plants. Workers broke ground in December 1952, and just within the past few weeks both plants have been virtually completed. They are incredible. Three of the stacks are the tallest ever built, towering 682 feet above the ground. Together

the two plants burn coal at a rate of 7,500,000 tons per year, enough to fill a train of hopper cars stretching all the way from New York City to Miami. Electricity is carried away on the tall shoulders of 1558 steel towers averaging 158 feet high, spaced four to a mile.

Workers Move Away

By the middle of 1955 this wave of construction had smashed against southern Ohio and now was receding almost as fast as it came. Workers were laid off by the hundreds each week. Long lines of trailers which had rolled into the area some 30 months before now were moving out, many of them tracking the yellow clay of Pike County north toward the St. Lawrence Seaway project.

GAT's 2750 permanent workers by this time had settled into the routine of their jobs. Visitors with business at the plant could drive around the perimeter, marveling at the tremendous plume of vapor that hangs over it constantly, reflecting the lights at night to cast an eerie glow across the sky. But not even the rashest of visitors would try to get by the big security force that is on duty to keep the secrets secret.

Townsfolk, some of them bitter, some of them glad, tried to go back to their former way of life. But the area isn't the same. In Waverly, brand-new homes stand vacant on street after street, permanent and attractive homes in eight new housing developments, homes that would be snapped up in other parts of the country. The government has auctioned off the demountable "flattops" in Waverly. Some of these temporary homes were sold for \$350 including plumbing, heater, water heater and kitchen range. Last winter rows of government

(Continued to page 246)

Town of Waverly, with homes standing empty, now is trying to attract new residents and industries



Just what paste wax needed - a built-in cleaner !



**Johnson's J-Wax
new Paste Wax Discovery
does the cleaning work for you!**



**Start right in waxing! No extra
cleaner needed—nothing else to buy!**

Here's what you've been waiting for—a paste wax with a cleaner built right in! Johnson's new J-Wax saves you hours of pre-cleaning. J-Wax takes the dirt off for you—replaces grime with a crystal-clear coating of wax. Even the dirt you can't wash off loosens instantly and disappears as you rub on this new self-cleaning paste wax.

Then watch the high brilliant luster that comes as you buff. J-Wax sets smooth and hard—bonds itself into a long-lasting wax-tight seal. Gives your car tough wax protection it needs for any weather. And look! The colors are far brighter, truer—even the chrome glistens.

Get your car ready now for the months ahead—with J-Wax. It's the easiest, fastest way to genuine wax protection—*paste wax protection!*



Proved in years-ahead motors...
Quaker State gives
smoothest performance today!



Super-refined from Pure Pennsylvania Grade Crude
Oil, world's finest. Famous for performance,
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QUAKER STATE OIL REFINING CORP., OIL CITY, PA.
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trailers were standing deserted in the empty streets.

Piketon has formed a Chamber of Commerce to try to attract new industry which will take up the slack. Waverly's mayor, A. S. Keechle, a former Linotype operator, has appointed a committee of prominent citizens for the same purpose.

"When this thing started," says Mayor Keechle, "this town owed only \$20,000. Now, because of our new water system, we owe \$600,000. We have a population of 6313, but we're equipped to handle 20,000 people. We're determined to get them. We can offer any industry good homes, standing ready for its workers. We have an unlimited supply of water, schools with plenty of classroom space, and all the low-cost electricity any industry could need."

New industries are taking up the slack somewhat. Near Portsmouth there's been a \$64,000,000 expansion of the Detroit Steel Corporation's steel mill. The Olin Mathieson Chemical Corporation is building a \$90,000,000 plant at Clarington, Ohio, which will help. In the town of Waverly alone, since the atom came, there are 20 to 25 new businesses.

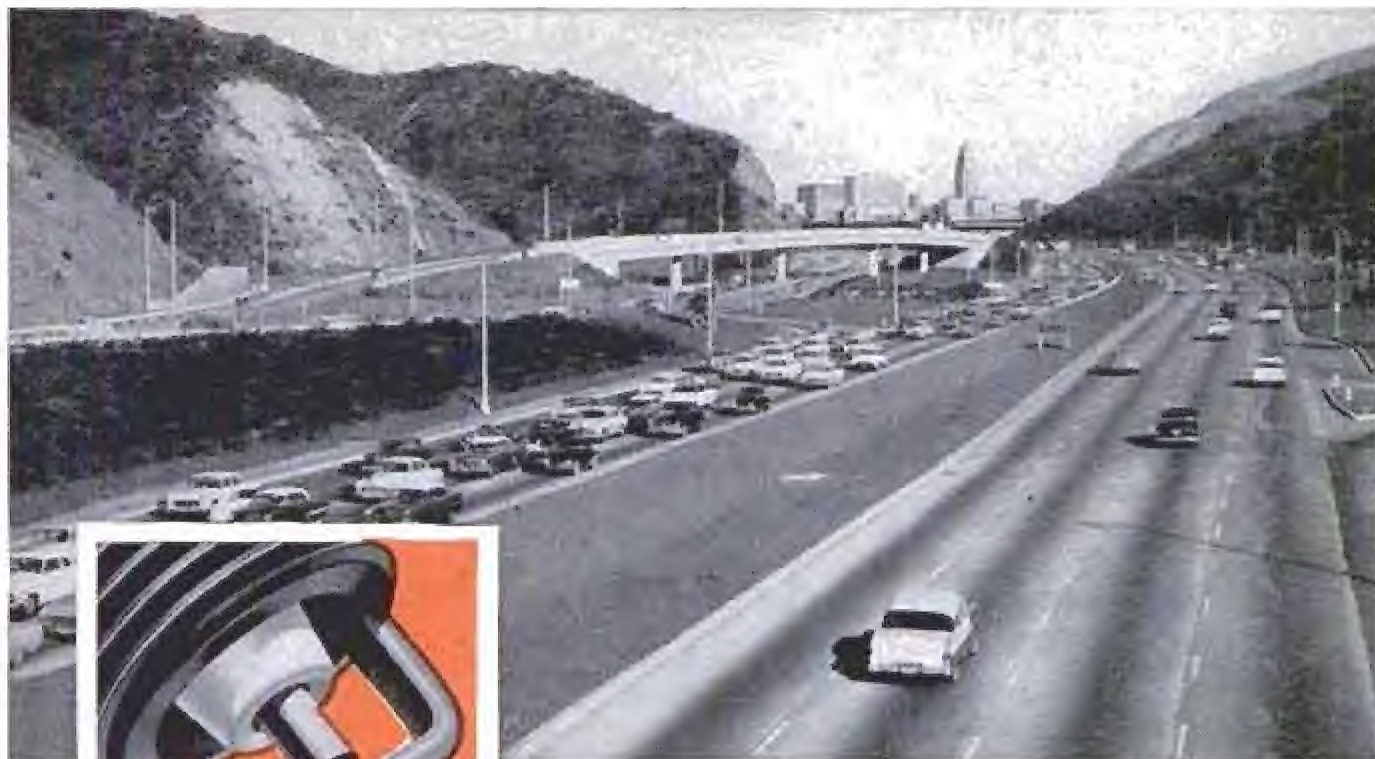
Pinch on Older Folks

How did the area come out of the boom? Probably only a few people suffered in terms of dollars. Clarence L. Adams, who has been a barber in Portsmouth for 35 years, says, "The pinch was hardest on older folks who had retired. Their taxes went up so high a few of them had to sell out and move away. On the other hand, others who had wanted to sell for a long time and couldn't find a buyer now are living in Florida."

GAT's employees, thanks to Paul Bliss' well-planned community-relations program, are thoroughly integrated into the community. "We aren't outsiders anymore," says Bliss. "The average age of GAT workers is 30, and a good many of the men have married local girls. The older ones now are serving on church boards, city councils and school boards."

Today if you visit the area you can buy uraniumburgers and stop overnight at the Atomic Trailer Court. You can watch the races at the Atomic Speedway and pick up your victuals at the Atomic Grocery—Get Your Energy Here.

The atom that touched off the explosion over the Scioto Valley is there to stay. One of America's biggest industrial plants, hidden in the hills of Pike County, goes on sifting invisible and elusive little particles under a plume of vapor that billows upward day and night. ★ ★ ★



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Some spark plugs are designed for high speeds, but . . .

Only new **POWER TIP** "fires up" your engine at all speeds!

Auto-Lite Resistor Spark Plug with Power Tip is the first and only spark plug ignition-engineered for today's engines and today's driving.

Up until now you just couldn't get a spark plug that would continue to operate at top efficiency at all speeds! Either you got "hot" plugs that were satisfactory for city driving only . . . or "cold" plugs that were fine at higher speeds but easily fouled at lower speeds, causing engine misfire, wasting fuel and power.

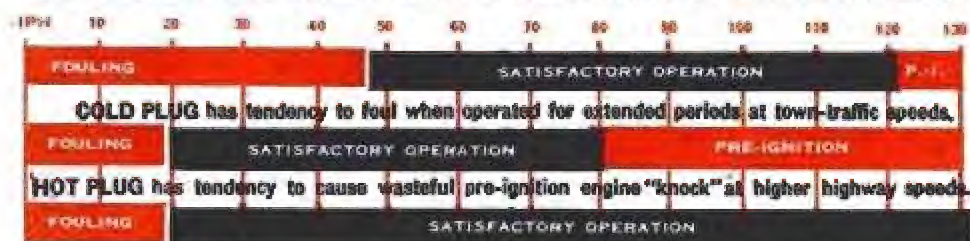
Now at last there's a spark plug that's hot enough at low speeds to resist fouling and cold enough at highway speeds to check destructive pre-ignition. It's the revolutionary new Auto-Lite

Resistor Spark Plug with Power Tip! It's the only spark plug that "fires up" your engine for peak performance and economy at all speeds.

The protruding Power Tip makes the difference. It gets hotter than the conventional plug at low speeds because the Power Tip extends into the combustion chamber. It resists fouling because fuel deposits burn away clean. Yet at high speeds Power Tip gets the full benefit of the cooling intake gases. It "keeps cool" to check destructive pre-ignition.

Fits all these cars with overhead-valve V-8 engines using 14 mm. spark plugs . . . Buick, Cadillac, Chevrolet, Chrysler, DeSoto, Dodge, Ford, Hudson, Imperial, Lincoln, Mercury, Nash, Oldsmobile, Packard, Plymouth, Pontiac, and Studebaker. See your nearest Auto-Lite Spark Plug Dealer.

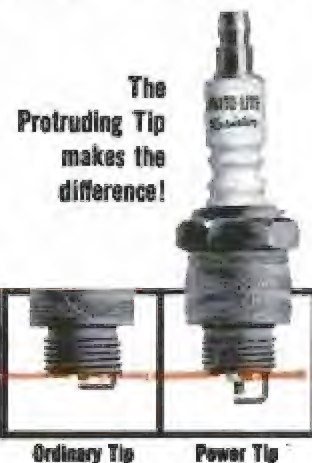
ENGINEERING CHART SHOWS HOW ONLY POWER TIP DELIVERS TOP PERFORMANCE AND ECONOMY AT ALL SPEEDS.



AUTO-LITE RESISTOR SPARK PLUG WITH POWER TIP . . . for all speeds.

AUTO-LITE **POWER TIP**

Auto-Lite manufactures over 400 products, including Spark Plugs, Batteries, Wire and Cable and Automotive Electrical Systems . . . sold throughout the United States and Canada.



Which *finishing* Weldwood® Wizard can help you today?



It's a good idea to keep them all handy. You never know what finishing problem may develop in working with wood. As products of the world's largest plywood organization, these "wizards" are designed to give you expert results in many finishing tasks.

For protecting and bringing out the natural beauty of any wood—use **SATINLAC**®

Makes the most practical, beautiful and durable natural finish for hard or soft wood! So quick-drying you can apply 3 coats a day. SATINLAC is so easy to maintain!



For blond woodsy effects without a "painty" look—use

WHITE FIRZITE®



Versatile! A two-fold boon: (1) As an undercoater for soft wood or plywood paint jobs, seals pores to help prevent grain raise and checking. (2) As a finish, produces a blond woodsy finish with no "painty" look. Great for pickled and wiped effects too!

For making fir plywood look like costlier woods—use

CLEAR FIRZITE®

Magic action for plywood stain jobs! Tame wild grain with a starting coat of Clear Firzite—add colors in oil to achieve the rich look of oak, walnut, mahogany. Clear Firzite also helps prevent grain raise and face checking.



Ask your hardware, paint, or lumber dealer about these Weldwood Finishing Wizards... or mail coupon for FREE leaflets.

UNITED STATES PLYWOOD CORPORATION
Box 525—New York 46, N. Y. PM 5-65

Send me leaflets on:

☐ Satinlac ☐ White Firzite ☐ Clear Firzite

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Build Your Own Hi-Fi Speaker Enclosure

(Continued from page 162)

systems (Electro-Voice Corp., Buchanan, Mich.) has made his entire line of enclosures available in kit form. What's more, the plans and instructions for building any of these are available at a very low cost so that the more hardy individualist can build his enclosure by cutting the lumber himself.

Electro-Voice enclosure kits can be bought in a variety of sizes ranging from the diminutive 23-in.-high Baronet to the impressive 57½-in. Patrician 1V. They are suitable for use with most coaxial or tri-axial speakers, and separate 2 and 3-way speaker systems.

Also available in kit form is the patented and widely copied "Klipschorn" (Klipsch and Associates, Hope, Ark.). Especially designed as a corner enclosure, it will provide best results with separate woofer-tweeter speaker combinations. By utilizing the corner walls of the room as part of the sound-radiation system, the Klipsch enclosure has long been recognized for its excellent bass response and wide sound dispersion.

Versatility Plus Style

One of the latest and most widely discussed enclosures, the Karlson (Karlson Associates, Inc., Brooklyn 29, N. Y.), has achieved wide acclaim. It offers the utmost in versatility, outstanding bass response and unusual styling. The Karlson is primarily designed for coaxial or triaxial speakers, or single-cone units. It is claimed to improve the performance of even the least expensive of the hi-fi speakers by a remarkable degree.

Not limited to corner installations, the Karlson can provide some very unusual effects. When laid on its side against a wall, it gives the illusion that the music is radiating from the entire wall, "as though the wall were a sound-transparent curtain in front of a stage" (according to an independent research organization). This effect is highly pleasing to some listeners.

High-fidelity speaker-enclosure kits are also available in a wide variety of designs and styles from Cabinart (G. & H. Wood Products Co., Brooklyn, N. Y.); River Edge Sales Corp., Port Washington, N. Y., and other manufacturers. Among these are units whose appearance will please even the most discriminating interior decorator, and whose performance will enhance the quality of all loudspeakers.

While a well-designed enclosure is a

(Continued to page 250)

Which Weldwood® Wizard can help you today?



What are you making or mending? Do you know about Weldwood's new developments in adhesives? Do you know that you need special glues for special jobs? Do you keep on hand all 4 of these Weldwood Wizards, developed to make your jobs easier, quicker?

For wood-to-wood joints that never come loose—use **WELDWOOD Plastic Resin GLUE**

Imagine—joints glued with this Wizard are stronger than the wood itself! And they grow even stronger with age! That's why it's America's most popular wood glue. Highly water-resistant, stain- and rot-proof. Easy-to-mix powder. 15c, 35c, 65c and larger sizes.



For weatherproof boat repairs—use **WELDWOOD WATERPROOF RESORCINOL GLUE**

100% Waterproof! A "must" for any wood gluing exposed to climate, boiling or salt water, cold weather, mold, fungus, mild acids, alkalies, etc. Terrific for sporting goods, woodwork in damp basements, lawn furniture. ¼ pints, pints, quarts, gallons.



For in-a-hurry gluing of wood, paper, cloth, fabric—use **WELDWOOD PRESTO-SET® GLUE**

Ready to use. Sets fast! Glues like magic! Presto-Set is the Weldwood-perfected white glue that bonds wood to wood, wood to cloth, cloth to paper, upholstery fabrics to wood, leather to leather, etc. Clean to work with—no sticky hands. 25c, 45c tubes; pint and quart jars.



For putting up plywood panels without nails—use **WELDWOOD CONTACT CEMENT**

Revolutionary! Speedier, easier, new way to install plywood panels. No nails, no holes to fill and finish. Bonds instantly, permanently on contact. No clamps and presses—ideal for applying plastic laminates like Micarta to table tops, kitchen counters, etc. 1001 other uses for home, hobby, garage. 25c, 35c, 60c and larger sizes.



There's a special Weldwood Wizard for every gluing job. Ask your lumber, paint or hardware dealer... or mail coupon for FREE leaflets.

UNITED STATES PLYWOOD CORPORATION
Box 525 — New York 46, N. Y. PM 5-88

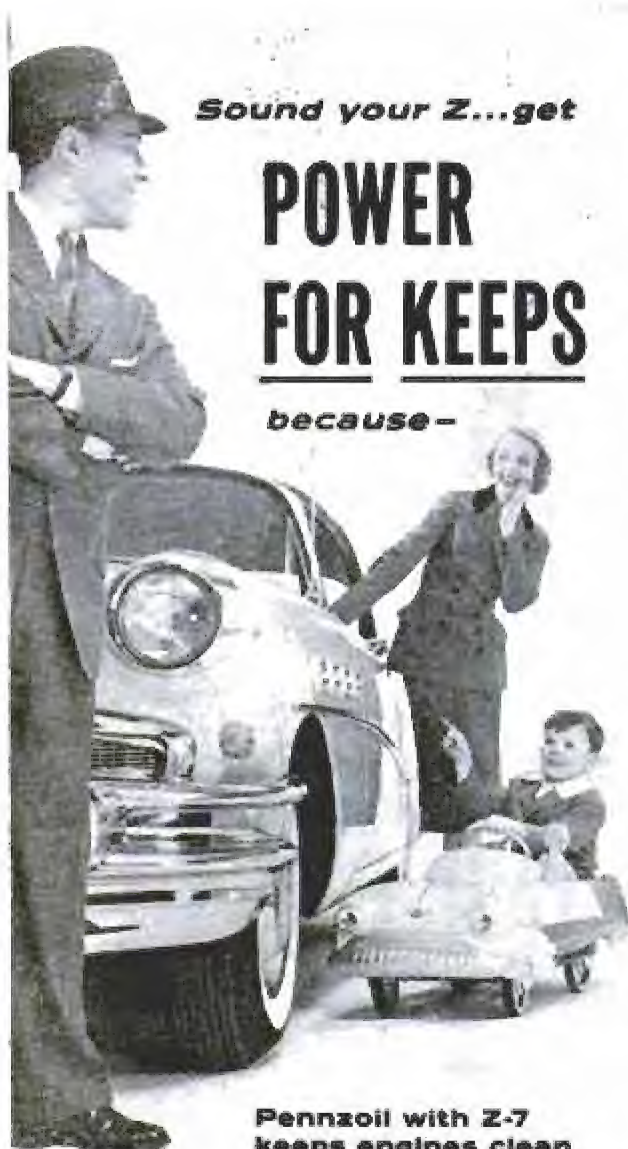
Send me leaflets on:

- ☐ Weldwood Plastic Resin Glue
- ☐ Weldwood Waterproof Resorcinol Glue
- ☐ Weldwood Presto-Set Glue
- ☐ Weldwood Contact Cement

NAME _____

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CITY _____ ZONE _____ STATE _____



Sound your Z...get

POWER FOR KEEPS

because—

**Pennzoil with Z-7
keeps engines clean**

Pennzoil with Z-7 is The Tough-Film® oil with an all-oil lubricating body. It stays tough under engine heat and pressures, prevents build-up of power-stealing deposits. By keeping engines clean, this different Pennsylvania motor oil controls carbon completely. There's no knock, no ping. Horsepower stays unlocked—not for just a few miles after an oil change, but for keeps. To enjoy all the smooth power you bought, get Pennzoil with Z-7 now in the exact seasonal grade for your car!



IN EVERY STATE,
AT DEALERS WHO
Care FOR YOUR CAR

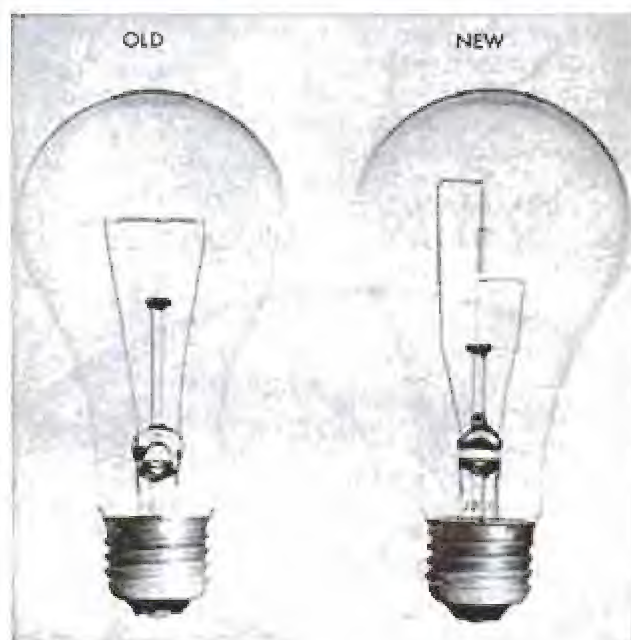
MEMBER PENN. GRADE CRUDE OIL ASSN., PERMIT NO. 2, OIL CITY, PA.

must for all high-fidelity systems, it will also improve the performance of loud-speakers presently housed in open-backed radio or television console cabinets. The installation of such speakers in a separate hi-fi enclosure usually results in a marked increase of fundamental bass reproduction.

Although all speakers will sound better in a good enclosure, some of them will provide optimum performance only with a specific type of cabinet design. Speaker manufacturers can usually supply information on cabinets which will result in best possible performance with their particular units. On the other hand, the makers of enclosures can often recommend speakers which will provide best performance in their particular cabinets. Such recommendations, as well as additional descriptive literature and illustrations, can be obtained directly from the manufacturer, or from the radio-parts distributors handling their products. ★ ★ ★

Improved Light Bulb Is More Efficient

Light bulbs give more light with the same amount of electricity because of an improved design. The tungsten filament is positioned lengthwise in the bulb, permitting it to burn at a higher, more efficient temperature. Bulb blackening is concentrated in a smaller area, permitting more light to escape. The increased efficiency amounts to 6 percent in household bulbs and 15 percent in the larger industrial sizes. Double-coil filaments, formerly restricted to small-wattage bulbs, account for the greater increase of efficiency in the over-300-watt bulbs. The new bulbs are made by General Electric.





Biggest value ever!

Sensational new heavy-duty saw

—only **\$69⁵⁰**

At last—true heavy-duty design and precision engineering in a *professional quality* 6½" saw!

Porter-Cable's revolutionary new Model 146 has the *capacity* you need—makes every cut it takes to build a house! It slices through 2" dressed lumber—even at a 45° angle—with speed and power to spare. It does everything that bigger saws can do—does it *easier*—does it all day long without a whimper.

Model 146 is light and handy—just 11 lbs. of perfect "feel" and balance. And just check its features! Full ball-bearing construction, telescoping guard, exclusive new calibrated depth gauge, famous Porter-Cable Kick-Proof Clutch, husky 9-ampere Universal motor (1.3 equivalent h.p.) and many, many more.

See the new Model 146 at your dealer's *now*—or mail the coupon below. At only \$69.50, it's the saw "buy" of the century!

SEE YOUR DEALER — OR MAIL COUPON TODAY!

PORTER-CABLE MACHINE CO.
6145 N. Salina St., Syracuse 8, N. Y.

Yes, send me a complete catalog sheet on the Model 146 Heavy-Duty Saw, and the name of my nearest dealer.

Name _____

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City _____ Zone _____ State _____

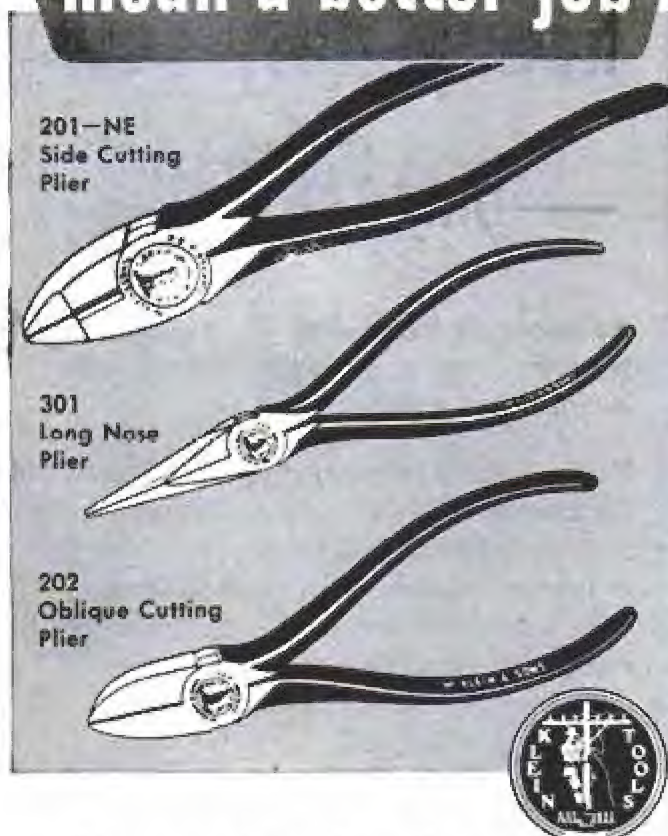
Porter-Cable

Quality Electric Tools

First with the finest for 50 years

KLEINS

mean a better job



Here are three pliers that will help you do a better job—three tools that should be in every workman's kit.

Klein pliers are recognized by electricians, linemen and good workmen everywhere as the standard of comparison by which other pliers are judged.

The work you do is only as good as the tools you use. Be sure the tools on your bench or in your kit include genuine Kleins, famous for quality "since 1857."



Your hardware store has Kleins in stock or can get them for you quickly. Look for this new display board. It shows the most popular items in the Klein line.

Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

Humidity-Controlled Electronic Switch

(Continued from page 164)

obtaining satisfactory operation. The only necessary precaution is to keep the wire leading to the grid pin of the tube socket and the lead from the tie point to the sensing element well separated from any leads carrying alternating current. Failure to observe this may result in the induction of hum into the grid circuit which might cause unstable operation.

The line-cord leads are soldered to the terminal strip after passing through a hole in the case. A rubber grommet inserted in the hole protects the cord against damage. A knot in the cord, just inside the case, will act as a strain relief.

The sensing element is made of a plastic container, such as the shallow lid of a cheese carton, and two all-metal banana plugs, which serve as electrodes. These plugs are fastened to the plastic lid through two holes spaced approximately 1 in. apart. The exact spacing of the plugs is not critical, but the holes in the lid must line up perfectly with two corresponding jack holes in the top of the metal case. The lid itself must be shallow to permit the free access of air.

The jacks must be well insulated from the case by means of the insulating shoulder washers supplied with the jacks.

After the final wiring has been completed the unit may be tested before it is installed in the case. To do this, fasten the sensing-element leads to the jacks mounted on the case and insert the fuses in the line-cord plug. These fuses must have a high enough current rating to handle the surge current drawn by the dehumidifier. Pour a small amount of salt of the free-pouring variety into the sensing element and insert the line-cord plug in a wall outlet. (Use just enough salt to make good contact with both sensing electrodes. A random sprinkling of salt, as shown in the photo, page 163, can be used.)

When the unit is plugged in, the bulb will light if the sensitivity control is turned fully counterclockwise. Rotate this control until the bulb is extinguished. Then breathe into the salt as you would on a pair of glasses in order to clean them. After one or two long breaths, the bulb will light and remain lit for a short time, until the moisture has evaporated. Then it will go out. This indicates that the unit is operating properly.

The value of capacitor C1, across the relay coil, is somewhat critical. Too small a

(Continued to page 254)



At Bonneville Salt Flats . . .

Records Prove Top Performance of Auto-Lite Original Service Parts

31,224 miles of continuous driving averaging 92.86 mph! 306 official A.A.A. records, including 27 World's Unlimited Records, shattered! That's the record set by an Auto-Lite equipped 1956 Dodge at the famous Bonneville Salt Flats, Utah. And in those 14 blistering days and nights of continuous driving, not a single electrical failure occurred.

This amazing performance by the complete Auto-Lite electrical system . . . standard factory equipment on the Dodge . . . is important to every car and truck owner. When new electrical units are needed on your Auto-Lite equipped car, make sure you get Auto-Lite Original Service Parts. It's your guarantee of full power performance.

Engineers of many leading makes of America's finest cars specify Auto-Lite complete electrical systems as original equipment. That's sound support for your decision to insist on Auto-Lite Original Service Parts.



Whether it's a contact set, coil, condenser, distributor or voltage regulator, you can be certain of top performance if it's backed by world-famous Auto-Lite ignition engineering. Get these same race-tested electrical parts for your Auto-Lite equipped car.

Get full power performance with . . .

AUTO-LITE

Original
Service Parts



Auto-Lite manufactures over 400 products, including Spark Plugs, Batteries, Wire and Cable, and Automotive Electrical Systems . . . sold throughout the United States and Canada.



**"Our New CHILDERS
CARPORT Saved Us
\$95 and we installed it
in Just One Afternoon"**

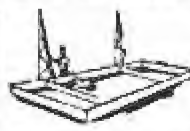
Install the beautiful Childers Do-It-Yourself Carport in one afternoon, save \$95 over the price of a job-built carport. Beautifully designed to blend with any type architecture, it increases the value of your property. Your Childers Carport can be used in many ways — as protection for your car, a patio cover, a play area for children. Precision-made from zinc plated steel, it will last as long as your home.

Erect in one afternoon. Full size, 20'x10'. Nothing Down, only \$2.48 a week. Free standing or attached.

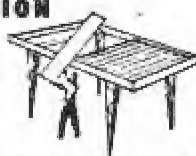
EASY 1-2-3 INSTALLATION



1. Assemble frame on ground.



2. Attach legs and raise carport.



3. Put roof sheets into place.

CHILDERS ALUMINUM AWNINGS GUARANTEED TO SAVE YOU 30%



Berkley



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Your cost will be at least 30% less than your neighbor paid last year for his old fashioned, job-built awnings because:

1. You get factory prices from direct factory outlet.
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Casement Awning



Door Canopy

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Send me free literature on the Childers guaranteed products checked below; also name of my local Childers factory outlet.

Childers Carport ☐ Childers Aluminum Awnings ☐
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Products

value will cause relay chatter, while too much capacity may cause the relay to flicker just before turning off. For this reason, a dual unit is specified in the parts list. If the 20-mfd. unit originally used causes relay flicker, it should be replaced with the 10-mfd. section. The unused lead should be taped and tucked away underneath the chassis. If relay chatter is encountered, the 10-mfd. section should be connected in parallel with the 20-mfd. section.

When installing the unit in the case, the bulb should be taped to the top of the case beneath the sensing element. If a pilot bulb socket is used, it can be fastened to the case with a screw and nut.

The filaments of the tube are powered by only half of the transformer filament winding. This reduced filament voltage effectively increases the life of the tube, and reduces the power consumption of the unit.

In actual operation, the sensitivity control is adjusted by the breath-blowing technique described earlier. It should be set so that the relay is activated by two long breaths, although actual experimentation may dictate the use of a more or less sensitive setting.

When wired as shown the unit can be used with a dehumidifier. If a humidifier control is desired, the wire from the a.c. receptacle should be connected to contact 3 of the relay instead of contact 2.

Finally, the case of the unit should be grounded during operation to prevent the build-up of a static charge. This can be done by running a wire inserted under one of the cabinet screws to some grounded metal object. ★ ★ ★

New Phonetic Alphabet For Air-Ground Communications

Coca, Metro, Nectar, Union and Extra have been thrown into the wastebasket, and have been replaced by Charlie, Mike, November, Uniform and X Ray. That's the word from the Civil Aeronautics Authority. And if this all sounds like voodoo Mumbo Jumbo, it isn't. It simply means that five letters in the phonetic alphabet, used in air-ground communications, have been replaced by five others which will cause less confusion. The change was made after tests in the United States, Canada and the United Kingdom. The revised international phonetic alphabet now reads:

A Alpha	J Juliett	R Romeo
B Bravo	K Kilo (Kee'loe)	S Sierra
C Charlie	L Lima	T Tango
D Delta	(Lee'mah)	U Uniform
E Echo	M Mike	V Victor
F Foxtrot	N November	W Whiskey
G Golf	O Oscar	X X Ray
H Hotel	P Papa (Pop'a)	Y Yankee
I India	Q Quebec	Z Zulu

Why grope your way like this in fog?



Get a pair of G-E *All-Weather* Headlamps... see better in any weather

NEW General Electric *All-Weather* Headlamps are so revolutionary they make all ordinary headlamps obsolete.

With ordinary headlamps, upward light is uncontrolled. This light is reflected back into your eyes by millions of tiny moisture particles—that is why seeing at night in fog, rain, or snow, is so difficult. New G-E *All-Weather* Headlamps have a special shield over the lower beam filament that blocks out uncontrolled upward

light. Kick-back glare is reduced to a minimum . . . you can see the road ahead more clearly.

On clear nights, the upper beam filament which is purposely not shielded, puts light farther down the road. You can see curves, dips and obstacles in time to slow down.

With a pair of G-E *All-Weather* Headlamps you get 25% more light. Passing oncoming cars is easier, too, because the light is concentrated where you need it—on the right-hand side of the road.

Replace your present headlamps with a pair of new G-E *All-Weather* headlamps. They can be quickly installed and accurately aimed for a surprisingly modest cost. Ask for them by name: G-E *All-Weather* Headlamps.

Miniature Lamp Dept., General Electric Co.,
Nela Park, Cleveland 12, Ohio

Progress Is Our Most Important Product

GENERAL  ELECTRIC



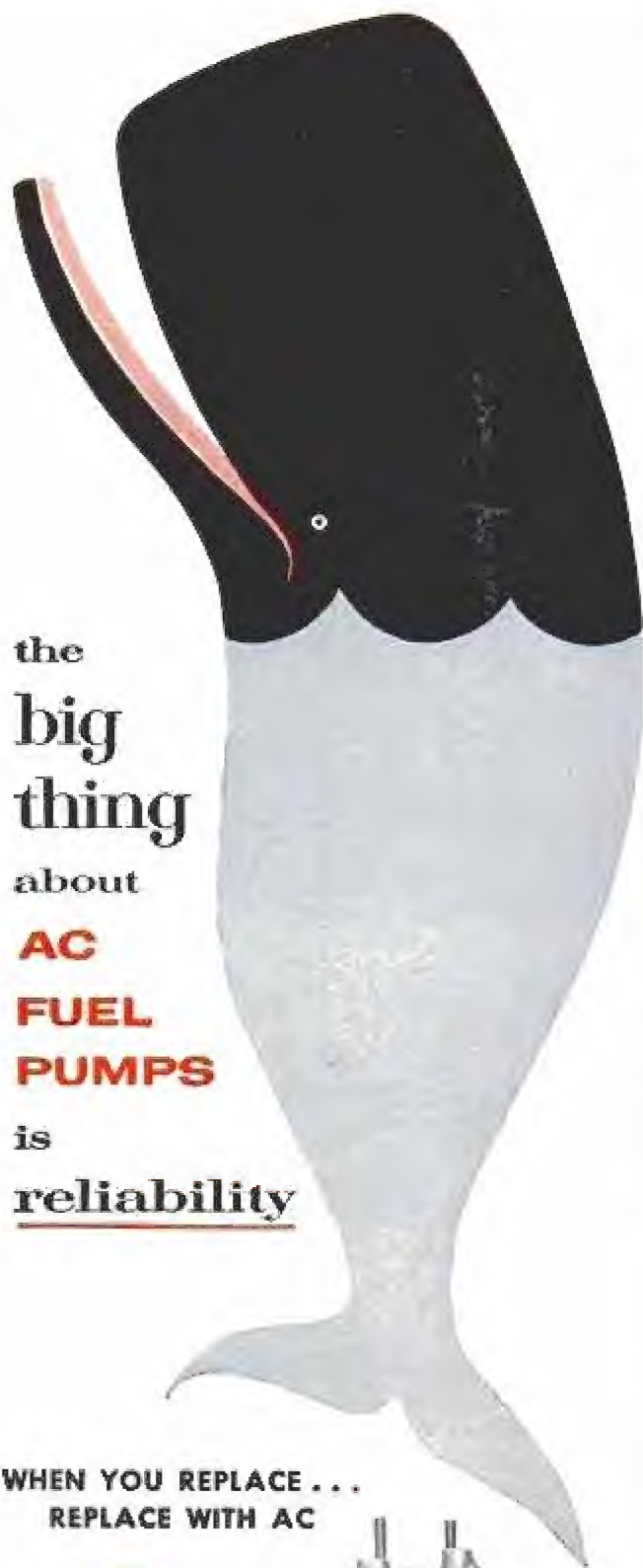
ORDINARY
HEADLAMPS

Ordinary Headlamps: Uncontrolled upward light bounces off moisture particles, causes kick-back glare, blinds driver.



G-E *All-Weather*
HEADLAMPS

G-E *All-Weather* Headlamps: G-E filament shield controls upward light, reduces kick-back glare, makes seeing easier.



the
big
thing
about
AC
FUEL
PUMPS
is
reliability

WHEN YOU REPLACE . . .
REPLACE WITH AC



AC SPARK PLUG 

THE ELECTRONICS DIVISION OF GENERAL MOTORS

Seabees Build Town Under Ice

(Continued from page 102)

plugged the gash, but for days there was no smoking on McMurdo Sound.

The cataclysmic disappearance of bay ice was not without its bright side. One of the problems facing Dave Canham and his men was transfer of loose fuel from the tanker to the 400,000-gallon tank farm they had assembled from pieces of prefabricated steel at Hut Point. With ice gone, and ships within four miles of camp, Seabee Weasels hauled strings of one-ton sleds loaded with 50-foot lengths of four-inch flexible hose. Working through whirling snowstorms most of the time, sled crews hitched length after length by means of jiffy-clip couplers. The Weasel driver would pull the train out from under each length as it was connected



Hot water was obtained by placing immersion heater in can and shoveling in snow—25-gallon capacity

to already laid hose. In four days, Antarctica's first "Big Inch" snaked across remaining bay ice to offloading point, and fuel flowed through it from ships to the continent's first big tank farm.

With all this completed, Whitney and his men still have plenty to do. Their polar villages are complete enough so they'll have comfortable living this winter. But before the sun sets for good this month, an airstrip must be finished and GCA (ground control approach) equipment set up at McMurdo Sound. Big Air Force planes coming in next December need a place to sit down. Flying boxcars will be needed to make 100 round trips to the South Pole, where they'll airdrop 20 men plus 350 tons of material (including a 12-ton tractor) to construct South Pole Base. Another satellite town—Byrd Base—must be constructed next October, 600 miles out on the unexplored barrier east of Little America

(Continued to page 258)

DO IT BETTER...
DO IT WITH DP



**GLAZE
CAULK
SEAL
PATCH**

Broken window panes? Glaze and seal 'em for keeps with **D-P Glazing Compound**. Works perfectly on wood, steel, aluminum... gives a permanent, elastic seal between glass and sash. Easy to use, looks better, lasts longer, no annual retouching. Just one of the many fine **D-P** products... at all good stores!

Ask your dealer for **D-P** Products.

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INSIST ON D-P **BEST SINCE 1867**



GENUINE ALNICO
MAGNETS

AMAZING, PERMANENT, NON-ELECTRIC, HIGHLY PRACTICAL. Conduct interesting experiments. Hundreds of uses. Retrieve valuable steel items such as guns, tackle from fresh or salt water; tools from tanks & drains. **GUARANTEED**. Try any magnet one week. Money back if you are not well-pleased.

No. M-710 Has pull of 225 lbs. on flat steel block.....	\$16.50
No. M-625 Has pull of 125 lbs. on flat steel block.....	\$9.50
No. M-575 Has pull of 75 lbs. on flat steel block.....	\$6.50
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No. M-47 Hot Pad Magnets. 10 for \$1.00.....	50 for \$4.87
No. M-35 Hobbyist assortment of 8 small magnets.....	\$1.50

Send M.O. or check. We pay postage. Sorry no C.O.D.'s.

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 for as little as **\$3 per week**

Start enjoying **SHOPSMITH** now for only \$29 down, \$3 weekly. Start saving now! Savings on projects and home repairs can more than equal weekly payments. See your hardware dealer or Montgomery Ward store. Write for 2 big, free, illustrated books.

SHOPSMITH, Dept. 321-B, Menlo Park, Cal., or Box 2808, Ft. Wayne, Ind.

NEW CONVENIENCE AND BEAUTY
NEW HULL AUTO COMPASS



Enjoy greater-than-ever-convenience with the **NEW Hull Auto Compass**... easier installation, easier compensation, easier reading. Its sparkling, new beauty of styling is easy to admire, too. At better dealers everywhere. Write for literature.

NEW COMBINATION MOUNT STANDS ON DASH, OR HANGS FROM WINDSHIELD MOULDING OR GLASS





Beaconlite® \$6.50
 illuminated

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**"We made our home
 15° cooler in summertime**



with Gold Bond
TWINSULATION®

"'Twinsulating' our attic gave us our first comfortable summer. And the job took just a few hours. We simply tucked the blankets between the rafters, from the floor up to and between the crossbeams, stapling as we went.

"TWINSULATION not only keeps our home cool in summer; it cuts winter fuel bills up to 25%. It's called TWINSULATION for its twin-insulating action. It *blocks* heat with fireproof rock wool, *reflects* heat with a covering of silvery aluminum all around."

"Twinsulate" your attic—before summer. See your Gold Bond dealer. He'll show you samples and supply a stapler for application.

NATIONAL GYPSUM COMPANY
 Buffalo 2, N. Y.



Send for booklet that tells all about Gold Bond TWINSULATION... what it does for your home, how it cuts fuel bills.



NATIONAL GYPSUM COMPANY
 Dept. PM 56, Buffalo 2, N. Y.

I enclose 10¢ for "Home Insulation" booklet.

Name _____

Address _____

City _____ County _____ State _____

*"My 6 big reasons for
buying this Fiberglas[®]
Boat-Covering Kit!"*



- It'll make my boat leak-proof and dry!
- I'll be saying 'so long' to scraping, sanding, caulking—and be first in the water every spring.
- My boat'll be stronger and more rigid—more resistant to hull damage!
- It'll get a longer lease on life!
- I get resin, activator, color pigment and Fiberglas fabric all together. No shopping around!
- I'll spend less time on maintenance, more time on the water.

Over 400,000 boat owners have improved their boats this way! How about you? For covering materials, see your local marine dealer. Or, for step-by-step instructions, write me for my free boat-covering booklet and a list of kit suppliers. Charlie M., Dept. 178-E, Essex, Conn.



OWENS-CORNING
FIBERGLAS

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—a high, inland snow prairie vaguely encompassing a 10,000-square-mile expanse known as Marie Byrd Land.

As you read this, Vic Young is preparing the huge tractor train that will follow a flag-marked trail some 400 miles into Marie Byrd Land. He'll carry 550 tons of gear to build Byrd Base next fall. That train will be the most awesome caravan Antarctica has ever seen. Painted bright orange for quick identification from air or ground, the half-mile-long string composed of 22 monster sleds drawn by ten 35-ton "snowshoe" tractors will set out early in October when the weather begins to "warm up." Vic will command a group of 30 Seabees. Each will serve a hitch at the controls of a tractor.



Narrow runners on this bobsled trailer could not support a 3000-gallon fuel tank on sugarlike snow

Once he gets rolling, Vic expects to keep engines roaring and massive tracks spinning 24 hours a day, stopping only for refueling at caches he laid down every 50 miles during a lighter run last month. When off duty, men will eat in a messing wanigan on one of the big steel bobsleds, and nap in a bunkhouse on another.

The plan doesn't account for polar blizzards that will drive blankets of snow through the air until a "cat skinner" can't see the tail sled of the train ahead. That's when the caravan will have to halt. Runners will freeze fast. To start, drivers will ram back into the load, yank forward, ram back again—repeating the process until everyone is jerking spasmodically and something gives. "If it's the hitch," says Vic, "we'll have a welding torch along to fix it up. If it's the driver's neck, Doc Erlich will fix that when we get back." Like most men in MCB (Marine Construction Battalion) Special, Vic talks about his colossal assignment with breezy abandon, but no one treats Antarctica's treachery lightly.

The trail Vic will follow is a hard-won circuitous route. Marked by red flags, four to the mile, it winds eastward between

(Continued to page 260)

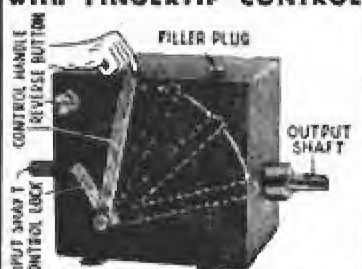
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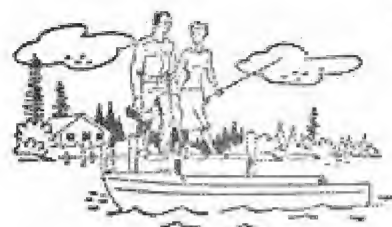
STATE

peaks of the Rockefeller Mountains that jut through the polar plateau like some lunar landscape. Lt. Comdr. Jack Bursey (USCG), who took a dog team 1200 miles into these same wastes in 1940, marked the trail for Vic last January. This time, as advisor to MCB trail parties, he first flew reconnaissance over his route in a ski-equipped Neptune. Then he rode overland with a "pathfinder" crew of six Seabees in a colorful train of sleds loaded with drums of fuel to cache en route for the return trip, rations and 2500 trail flags. The caravan was hauled by two Snocats and led by the crevasse-detector Weasel—all fitted with built-in bunks, cookstoves and heaters. Fuel for the outbound trip was in five-gallon tins on smaller dog sledges in the train.

"We'll live in the vehicles," Jack explained the day he took off. He demonstrated the removable plywood decks inside the Snocats, where kitchen utensils, duffel and food were stored. The benches on each side were converted to bunks that accommodated sleeping bags. The Weasel had a built-in bunk that folded up out of the way when not in use, and a generator on the rear deck to supply power for the "Angry Nine" radio transmitter. His Seabee crew—George Moss, chief surveyor; Alvah Edwards and Roland "Dick" Levesque, construction drivers; Charlie Wedemeyer, mechanic; Ray Dube, radioman, and Chester Stevens, photographer—were loading the last of the gear and gassing the vehicles. "We're taking 60 days of trail rations," Bursey revealed. "This includes pemmican, tea, oatmeal, chocolate and canned stuff." Pemmican, a highly nutritive concoction invented by Arctic Eskimos who use blubber as a base, comes in hard blocks like frozen butter. It's largely fat, with ground-up dried meat, berries, vegetable oils and a few dozen other ingredients. It can be cooked like cereal, or eaten cold in chunks. It sticks to the roof of your mouth and tastes like a mixture of lard and peanut butter—not recommended for steady diet, but great if you're starving on a polar waste. Bursey, who says he likes it, promptly was dubbed "Pemmican Jack" by the Seabees, who admit they don't.

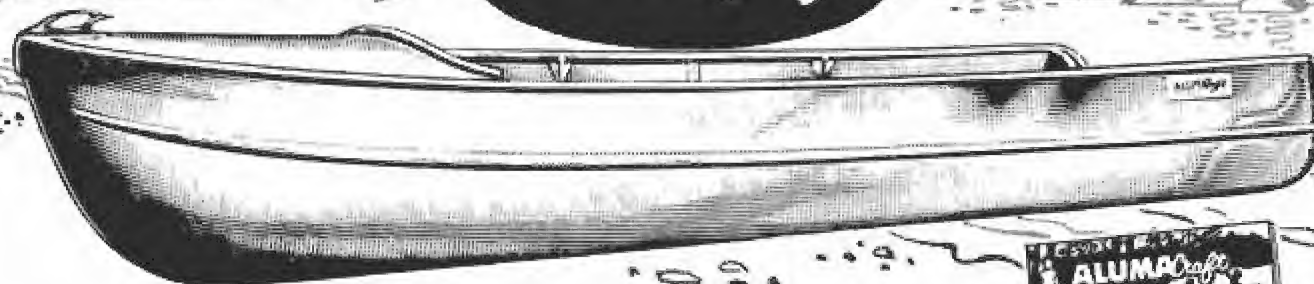
The tiny expedition roared out of Little America on a brilliant antarctic morning and disappeared over the horizon in a thin veil of drift. Each quarter mile, a bamboo pole topped by a fluttering red pennant was speared into the snow to mark safe trail for Vic Young's sled train. Every 50 miles the caravan stopped. Seabees trundled two 50-gallon drums of fuel from the sleds and planted them in the snow, marking the cache with a 20-foot-high flag so it

(Continued to page 262)



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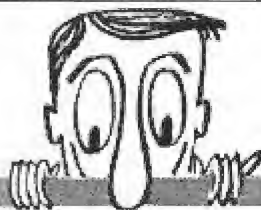
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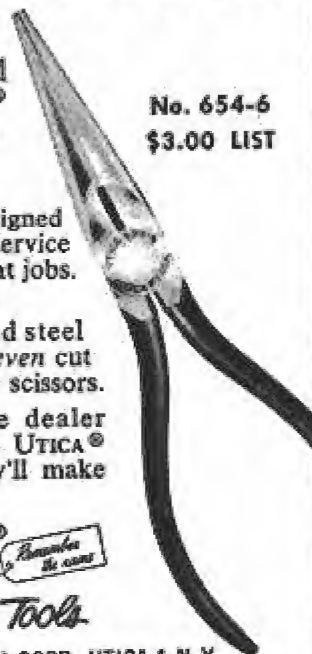
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would be readily found on the return trip.

Battered by blizzards and balked by white-outs, the trail blazers snaked nearly 400 miles up to the 6000-foot-high polar plateau. They circumvented mountains and rugged crevassed areas. Some of those cracks are 100 feet wide, so deep the bottoms fade into midnight blue, and they stretch away as far as you can see. "You don't ride across them like you do with dogs," Bursey pointed out. On his 1200-mile dog-team trek in 1940, Jack crossed the Hal Flood Range (where one peak was later named after him). He and three other men, all roped together, managed to cross snow bridges over huge crevasses with only a few minor incidents. "Several times the dogs broke through," he recalls. "But in each case the lead dogs were across and pulled the rest to safety. The men went over all of them safely on skis. "We made about 15 miles a day, instead of the 30 we're doing on this trip," he recalls.

The caravan was serviced on good days by a ski-wheel de Havilland Otter from the Little America snow airstrip. Across the featureless plateau, they steered by gyro-compass and celestial navigation. When blizzards hit, they holed in and camped in the vehicles and a polar tent.

Blazing trail across unexplored icecap with a light reconnaissance sled train, such as this one, takes considerable know-how. The man who briefed Bursey's Seabee crew on techniques for guiding their Snocat-and-Weasel safari was Silas B. Bowling, Army warrant officer with years of icecap experience in Greenland.

"Navigating is the big bugaboo," he explains. "Especially in white-out, when everything is one solid mass of nothing—shadows evaporate, snow mountains melt into the sky, ruts and holes disappear in a single white background that obliterates the horizon. Suddenly you are traversing the side of a hill—you keep working the side-slipping track on the downhill side, to straighten out your vehicle. In 10 minutes you may be hundreds of yards off course." It happened to a train of five sleds and two big tractors moving across Greenland. "Even though the navigator kept correcting course," says Si, "he wound up in a heavily crevassed area half a mile off trail, where he was found holed in—a few days later."

"Backsighting" is the trick George Moss and Jack Bursey used on their trail-blazing journey to stay on course in white-out. "If you know the direction you want to go, it works," Bowling explains. "We hit a white-out nine miles out of camp one day. I knew the heading we had to make, so took the lead vehicle and 20 flags. I laid out three

(Continued to page 264)

IDEAS FROM WELDWOOD

The Weldwood Question Box

Q. The doors in our house seem to transmit a lot of noise. How can this be corrected?

A. If wide cracks around the door are responsible for your problem, seal them with felt or rubber weather-stripping tacked to the door frame. But if the noise is coming *through* the doors, your best bet is to replace them with Weldwood Stay-Strate® Doors. The mineral core cuts noise transmission and, because Stay-Strate Doors won't warp or shrink, you'll effectively reduce sound *around* the doors.

Q. Must I use sheathing behind exterior plywood walls?

A. Yes—with three exceptions. Weldwood Texture 111, Exterior Weldtex® and Duraply® are approved by federal housing authorities in many areas for use without sheathing—a real saving of time and money. Check your local building laws first, though.

Q. How can I give birch plywood a natural finish?

A. It's easy. Go over plywood with No. 4/0 sandpaper—apply two coats of Satinlac®—let dry—then steel-wool and wax. For a "pickled" finish, first apply a coat of white Firzite®. Let stand a few minutes—wipe off with a clean cloth—follow with two coats of Satinlac, as above, then wax.

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55 West 44th St., New York 36, N.Y.

THIS MONTH'S PROJECT—THE "SINBAD" AQUA-SLED



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This month's hints

1. Make an inexpensive dining room table . . . quick to build, for your summer cottage, handsome enough for your own dining room. Buy one Weldwood hollow core flush door—they start from about \$15—screw wooden or metal legs to the solid part of the door (around the edges), and you're

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2. Finishing exposed plywood edges of tables or furniture is easy now. Get out your Presto-Set Glue and apply Weldwood Flexible Wood-Trim®. Comes in easy-to-use rolls 1" wide, 8' long. It can bend around corners . . . and matches wood perfectly because it's *real wood* itself.

\$10 For your Ideas

for "This Month's Hints." (Hints must apply to some Weldwood product.)
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flags, about 40 feet apart, aimed in the right direction. By sighting back across them, we crept ahead another 40 feet and planted another flag. We sighted back over that, and the ones behind it. By continuing the process, we made it right on the nose."

Even backsighting doesn't always work. On one 1200-mile tractor-train trip, Bowling suddenly found himself completely turned around in white-out, headed back toward where he'd come from. "We finally put two men on compasses and made a 180-degree turn," he recalls. "We couldn't even tell we were turning and wondered if the instruments were lying. They weren't."

The huge crevasses on the Marie Byrd Land plateau were hazard enough for the Bursey trail party, but white-outs and blizzards made them even worse. "In clear weather you spot the cracks. Sometimes they're just concave or humped patterns in the snow," Bowling explains. "In tension areas, where the huge ice mass is being pulled apart underneath by a rise in the sub-terrain, there will be jagged ice hills or 'haycocks.' In compression areas, where the ice is squeezed by fantastic forces, cracks are ridged, iced over, and you can't tell whether the chasms will be parallel or at right angles. They may be every way—all hidden by snow bridges. You generally find them after you've crashed into them."

Winding across limitless wastes can be hypnotizing and, for that reason, Moss and the other Seabee drivers shifted frequently. "Trailing vehicles can almost guide themselves in the tracks of the leaders," says Si, "and it's easy to fall asleep. I remember one long train where the fifth driver, hauling a wanigan, stopped to get something. The sixth Weasel kept coming. The driver was snoozing and letting the vehicle steer itself. He came to in the nick of time, swerved aside and took a door off No. 5."

"We used to spot lots of sleeping drivers behind us, in big trains. They'd drift off the trail every now and then, and we'd let them go out across the open spaces for a way, then send someone after them to wake them up. It was always an awful shock for a driver to wake up and find himself headed into nowhere."

None of Bursey's three trains wandered away. And nobody went through any cracks—though there were many lengthy detours to get around abysses. And there were other troubles to plague them. The tired engines broke down time after time. Tracks, made brittle by cold, shattered. Finally, the caravan ground to a halt on the plateau—still 200 miles from its goal.

Editor Dempewolf's reports on Operation Deepfreeze will continue in forthcoming issues.

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SHOCK ABSORBERS

The Gabriel Company • Cleveland, O.

What Owners Think of the 1956 Plymouth

(Continued from page 96)

"Mine is a taxi and the best thing is the way it handles."—Maryland cab driver.

"I like the way it handles on long trips. I never get tired."—Virginia meat cutter.

"Easiest handling car I have ever had and without power steering."—Illinois foreman.

Second on the list of features best-liked by owners of the six-cylinder Plymouth is the push-button shift. Second on the list of V8 owners is power and performance.

"Wonderful get-up-and-go, especially for passing and climbing hills."—Maryland nurse.

"On parking lots they call it the hottest on the lot."—California retired merchant.

"Plymouth has an engine I thought it would never have. It would be a good one to soup up for drag races."—Washington milkman.

Comfortable ride was third on the list of best-liked features among both V8 owners and six-cylinder owners.

"Plymouth rides perfect. Hundreds of miles in a day and not a bit tired."—California railroad worker.

"Rides comfortably. Has the 'heavy car' feel."—California examiner.

"Luxury feel. It has the sensation of a heavy car, but the price of a lightweight."—North Carolina foreman.

"Fits as comfortably as an old shoe."—Florida electrician.

"Seats are high enough for comfort."—Maryland inspector.

There Are Complaints

About one third of the Plymouth owners make no complaints at all about their cars. On the whole, V8 owners complain more than those with six-cylinder engines. The most-frequent complaint of V8 owners is poor gasoline economy (17.8 percent); the most-frequent complaint of the six-cylinder owners is the dash design and arrangement (only 8.6 percent).

"Poor gas mileage. I only average 13 miles per gallon. This is poor considering size of the car."—Indiana V8 owner.

"Had a few body squeaks, but they seem to have disappeared."—California chaplain.

Next on the complaint list of V8 owners are body rattles, dashboard design and poor body assembly. Among six-cylinder owners complaints include battery troubles, poor gas mileage and transmission trouble. Here are some V8 complaints:

"I have a four-door hardtop. The doors rattle."—Pennsylvania salesman.

"Don't like the dashboard setup in gen-

(Continued to page 268)

WARNING!



Today's high-powered engines need frequent spark plug checks to prevent dilution of oil

Don't change to summer oil without a spark plug check!

If you haven't checked your plugs in the last 5000 miles, they may be misfiring — and will dilute your new oil with gasoline!

It's a fact that every time a spark plug misses, raw gasoline remains in the cylinder and drains into your crankcase!

Naturally, this thins the oil so it can't properly protect costly engine parts . . . and may lead to a big repair bill.

So replace winter-worn plugs with new 5-rib Champions *before you change to summer-grade oil!* No matter what make or model car you drive, new full-firing Champions will protect your oil from dilution. What's more—they'll give you quicker starts, greater horsepower—and more miles per gallon of gasoline.

Ask your serviceman to check your spark plugs *today*. If you need new ones, insist on 5-rib Champions—the finest money



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SPARK PLUGS



Pete Penn says: "Mother Nature..."

stored her finest crude oil beneath the hills of the Pennsylvania Grade oil regions, where I come from."

That's why today's best motor oils are brands of Pennsylvania. No other motor oils are so *naturally* suited to the high-speed, high-temperature service of today's engines.

Take a tip from Pete Penn. At your *next* oil change, ask for a brand of Pennsylvania motor oil. Sold by good dealers everywhere.

Today's BEST Oils

**Start with Nature's Best Crude
...and that means Pennsylvania!**

INSIST ON A BRAND OF



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Motor Oil**

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eral, particularly the placing of the radio speaker. If you have a passenger, the volume will drive him out if you are to hear."
—Texas Navy man.

"Can't see the gas gauge because of the horn ring."—Maryland repairman.

"Engineering is unquestionably the best, but more than half the screws were not fully tightened. Some were barely started. Sun visors do not move easily. Trouble with trunk lock. Radio knobs rattle."—New York electrician.

Here are some quotations from six-cylinder owners:

"Battery trouble from the beginning. Now on the third battery."—New York bookkeeper.

"I get very poor gas mileage. The salesman told me there is nothing wrong with 11 miles per gallon around town. I don't have automatic transmission."—Pennsylvania repairman.

"PowerFlite transmission has too much jerk when changes from high to low."—Florida widow.

More Best-Liked Features

The following quotations describe other best-liked features and are listed in order of frequency of mention. For a detailed tabulation of percentages see page 95.

"Not too expensive to keep up."—Connecticut six-cylinder owner.

"Spacious and beautiful interior with matching washable upholstery."—Washington, D.C., mechanic.

"Engine is quite powerful for a small car. The six-cylinder engine and standard transmission use less gasoline."—Illinois clerk.

"You can see everything from the driver's seat. Backing is easy."—Massachusetts cook.

"I drive nearly 40,000 miles a year. I get economy and dependability with no breakdowns."—Maryland superintendent.

"I have operated taxi fleets since 1933 and find Plymouths best for troublefree operation."—Washington, D.C., cab operator.

"Sure starting in cold weather."—Maine truck driver.

"Lots of room inside. Three can sit in one seat very comfortably."—California truck driver.

"Brakes are excellent. Even when wet they always work."—California farmer.

"I service my Plymouth Six myself and find adjusting brakes and other maintenance simpler on Plymouth."—Virginia clerk.

"Hugs the curves at high speed."—New Hampshire caretaker.

"Best heater I ever had."—North Carolina farmer.

(Continued to page 270)

NEW!

CRESCENT SOCKETS, ATTACHMENTS AND SETS



Complete Set No. CSB18-
1/2" Square Drive. Twelve 12 point
sockets 7/16" to 1-1/4", three handles
and two extensions in a heavy gauge,
piano-hinged steel case.

"Midget" Set No. CMB16. 1/4" Square Drive. Eight
6 point and three 8 point sockets 3/16" to 7/16".
two handles and cross bar and two extensions in a
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Now you can get world-famous Crescent quality in a new, moderately priced line of Socket Wrenches. All popular sizes. Six set combinations: 1/4" and 1/2" square drives; 6, 8 and 12 point sockets; standard and deep types; and a variety of handles, drives and attachments. Precision machined from alloy steel, permitting thinner than average side walls with no sacrifice of strength. Chrome-plated — loaded with utility features. Ask your hardware dealer.

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Give Wings to Work

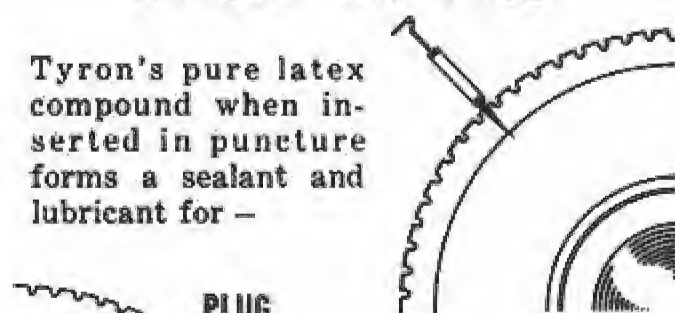
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Tyron's pure latex
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forms a sealant and
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When plug is inserted
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cording to directions
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*The use of Tyron's pure latex rubber
compound alone will repair tube-
type tires without removing the tube.
Shown at left; lifetime patch made
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"Tail fins make parking very simple. Just
sight along them and park."—New York
teacher.

"Conveniently arranged under hood for
servicing."—Connecticut physician.

"Defroster is wonderful."—Washington,
D.C., cab operator.

And More Complaints

For a list of the most-frequently men-
tioned complaints, turn to the table on
page 95. The following quotations describe
the complaints and are arranged in order
of frequency:

"V8-engine idle not set properly. Some-
times too slow, then too fast. Stalls fre-
quently during warm-up especially in rainy
weather."—Maryland scientist.

"Engine does not idle smoothly. Roars
like a jet when you are starting out."—
Wisconsin cemetery superintendent.

"Windshield leaks. Also doors."—Massa-
chusetts setup man.

"Roof over windshield leaked consider-
ably."—New York assistant manager.

"Glove compartment and ash tray give it
a look of cheapness."—Maryland mechanic.

"Interior decoration too inexpensive."—
Pennsylvania librarian.

"My complaint is with the dealer. I am
actually leery of taking the car to them for
service for fear they would foul it up some
way."—New Jersey worker.

"Dealer service is fine, but the Plymouth
factory doesn't send replacement parts on
time. I waited two months for a dash-light
switch and sun visor to replace those that
were defective."—Connecticut mechanic.

"Transmission slippage excessive. Howls
with grinding noise up to 35 miles per
hour."—California maintenance man.

"Door doesn't fit right."—New Jersey
housewife.

"Dome light goes on only with operation
of right front door."—Wisconsin minister.

"Door handle broke. Window handles
keep falling off. When gas tank is below
half full, gas gauge jumps continually and
it is impossible to tell gas level."—New
Jersey project engineer.

"Gas indicator has continuous wide quiv-
er that dealer says is normal."—New York
clerk.

"Insufficient take-off with six-cylinder
engine."—California accountant.

"Hard to start in cold or rainy weather."
—New Jersey six-cylinder owner.

The following complaints, while not men-
tioned by very many owners, are interest-
ing and valid enough to merit quotation:

"Trunk lid closes too hard. Have to bang
lid so hard it sways car up and down. Road
dirt covers apron in rear under back-up

(Continued to page 272)

BIGGEST SAW VALUE

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Completely NEW DURO MASTER 8" Tilting Arbor Saw

Here is everything you ever wanted in a power saw. Design, quality, precision, ruggedness and low cost. The *all new* DURO MASTER 8" Tilting Arbor Saw includes all important features and operating advantages including: "floating" motor shift, precision ball bearings, rugged "quick lock" rip fence, handy blade raising and lowering knob, one piece steel frame, convenient blade tilting mechanism with graduated scale and modern safety guard. And only DURO MASTER offers built-in conversion and adaptation features for tomorrow's needs, too!



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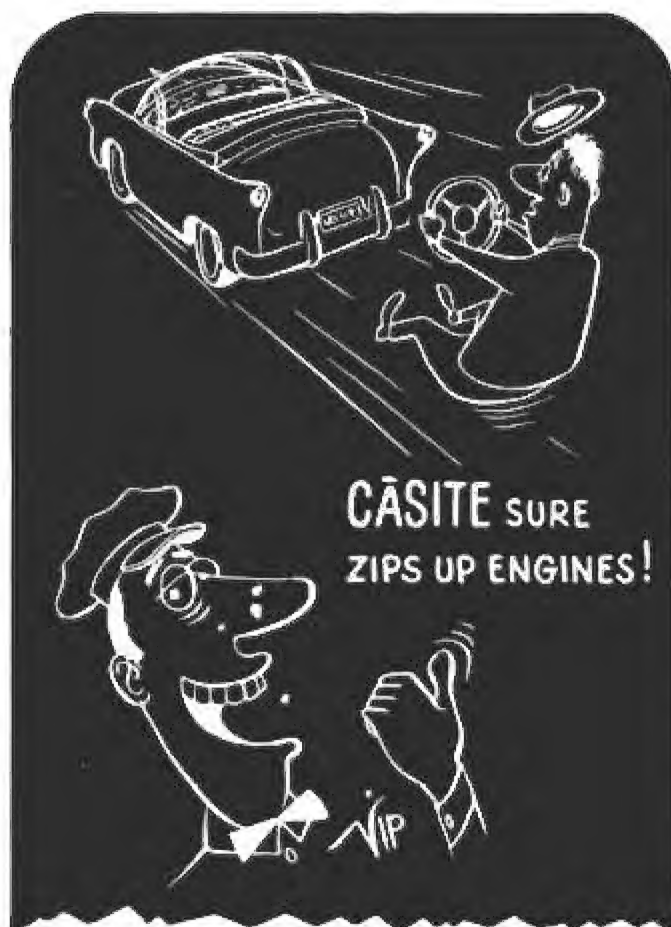
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lights."—New York hospital attendant.

"Both sun visors were too tight. Could not be used."—Indiana inspector.

"The emergency brake handle is L-shaped and gives a child enough leverage to release it by pulling on one side. It happened to us once. We have had handle cut down. There should be a park position in the transmission for additional protection."—Connecticut toolmaker.

"Heater instructions are very poor. They confuse our family."—California oilman.

"I don't like the unreliability of prices from dealers. Prices are inflated to compensate for high trade-in allowances. No two dealers carry same price list."—Connecticut store owner.

"Front license plate should not mount on bumper where it gets battered."—Washington, D.C., lawyer.

"Don't like oil filter. You have to throw the whole unit away at 5000 miles. It costs over \$6 instead of merely \$1.69 for a new replacement element."—Illinois owner.

"Center piece of grille seems to stick out too far and is easily dented by another car backing into it."—Illinois businessman.

And that is the story on the 1956 Plymouth. It is the good and the bad, as told to our survey. These hundreds of owners who drove millions of miles provided the most comprehensive test ever published by *Popular Mechanics*. ★ ★ ★

Turn back to page 93 for Floyd Clymer's impressions of the Plymouth and to page 94 for Dale Kelly's engineering data.

Clymer Tests the 1956 Plymouth

(Continued from page 93)

the Mojave Desert and the Angelus Crest mountain highway.

I ran into snow with a sandstorm that caused the California Highway Patrol to close the Ridge Route for four hours, due to snowdrifts and winds of gale proportions. I cut across and drove the coast route to San Francisco. No dust entered the tight body, but the windstorm did a good job of sandblasting the windshield glass.

The big performance surprise was the increased wallop the V8 engine develops. Except for the increased acceleration and top speed, the 1956 model handled about the same as the last Plymouth tested. However, there is no complaint on this score, because Plymouth has always been one of the finest road cars in the low or medium-price field. It is not only comfortable and easy-riding, but roadability is tops, regardless of whether one is cornering, hitting bumps at high speed, or traveling over rough dirt roads. The car seems to loaf at

(Continued to page 274)

Get **MORE SPEED,**
SKILL, POWER
for **LESS MONEY!**

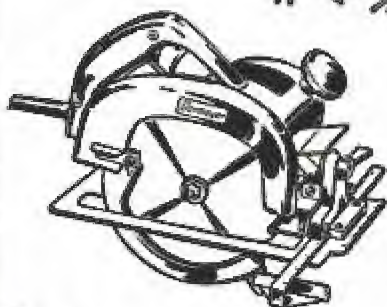
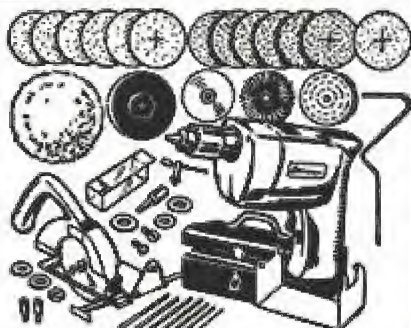
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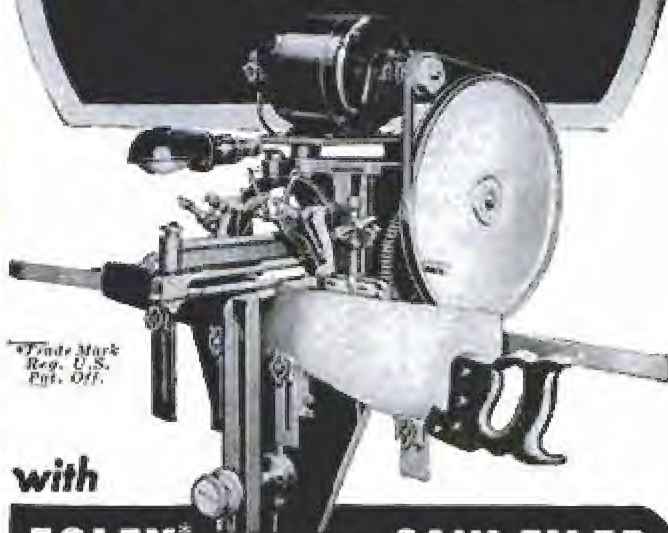
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90 to 95 miles per hour. Indicated top speed by speedometer was 110 miles per hour. The speedometer was found to be about 7 percent fast.

The Plymouth suspension system, as in the past, is tops. A combination of Plymouth's direct-action shock absorbers and a linkless stabilizer has much to do with Plymouth's excellent roadability. Front springing is rather soft, yet when cornering, control of the car is good, although there is above-average body roll. I like Plymouth's full-time power steering.

The test car was equipped with power-operated brakes, having 158 square inches of effective area and bonded (not riveted) brake linings are used. Brake shoes are individually anchored. There are two cylinders in each front wheel. Plymouth has one of the best sets of brakes I have ever used. Only slight fade was noticeable in stops from top speeds and on some steep, winding descents when brakes were used a lot.

Plymouth's PowerFlite automatic transmission is a torque converter with gears. With proper use of the throttle it shifts quite smoothly, but if handled carelessly shifting can be rough. The only objection I have is that above 55 miles per hour no kickdown gear is available. Below 55, if the throttle is floored, the car leaps forward with a surge as the lower gear comes into use. If the throttle is held down, the upshift takes place at about 63 miles per hour.

There is a minimum of engine vibration at any speed. There is some hood flutter at speed on rough or wavy roads. Wind noise and body rumble seem to be less than in previous Plymouths.

Plymouth's gas mileage has suffered as a result of larger displacement, more horsepower, automatic transmission and more weight. It can't match the old dependable L-head Six for economy, but the buyer of a 1956 car is apparently more interested in performance than in economy. The buyer must decide which he wants, as high performance and economy do not go together. I found regular gas to be satisfactory.

Interior appointments are of high quality, although the painted lower portion of the dash is not in keeping with the rest of the instrument panel. Instrument vision is good, but the full-circle horn ring is annoying because the top portion is directly in line of speedometer vision. The gasoline and temperature gauges are directly in front of the driver (also with vision obstructed by the horn ring). I have always liked Plymouth's electric windshield wipers. All lights are controlled by a left-hand-operated switch, as is the push-button-transmission control, which is located out

(Continued to page 276)



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—Purolator is best for every make of car!"

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OIL FILTERS

of reach of children. Plymouth now uses warning lights for generator and oil pressure. I prefer the needle indicators.

Directly in the center of the dash is the radio and it is a good one. Heater controls have been moved far to the right, directly in front of the passenger. The location is fine for the passenger, but requires considerable reaching for driver operation. The heater is effective.

There is a lot of leg and interior room. The driving position is most comfortable. The cushions and seat backs are well upholstered, with good springing. The brake pedal is wide and well located. The parking brake operates on the propeller shaft, independently of the wheel brakes. Applying and releasing is smooth as the operating rod slides through a pivoted bracket, which eliminates binding action.

Doors now open with a pull of the handle instead of by push button or a twisting movement. Closing of the doors is a little on the hard side. The doors have a solid feel and there was no evidence of dust leakage even after three hours of one of the worst sandstorms I ever drove through. Three turns of the crank lower or raise a window and cranking seems harder than on previous models.

Plymouth bumpers have no bulletlike projections front or rear, although the center of the bumper (where the license plate is mounted) is the first part of the bumper to touch another car. It is a poor location because it offers no protection for the license plate, which as a rule soon becomes battered from contact in parking. The counter-balanced rear-compartment lid is easily opened and closed. It is not self-locking and requires a key to lock it. ★ ★ ★

For engineering data on the Plymouth V8 turn back to Dale Kelly's report on page 94.

Artificial Respiration For Young Children

Children under two years old are given artificial respiration with a new method explained in the American Medical Journal. The child is held on the outstretched forearm of the operator, with the head face-down in the operator's hand and the legs straddling the elbow joint. The tongue is depressed with a finger. The operator lowers and raises forearm and baby eight to twelve times per minute in a 90-degree arc bisected by the parallel. The baby's abdominal organs push and tug on the diaphragm, forcing air in and out of the lungs. The easily learned method prevents injuries possible with other systems.



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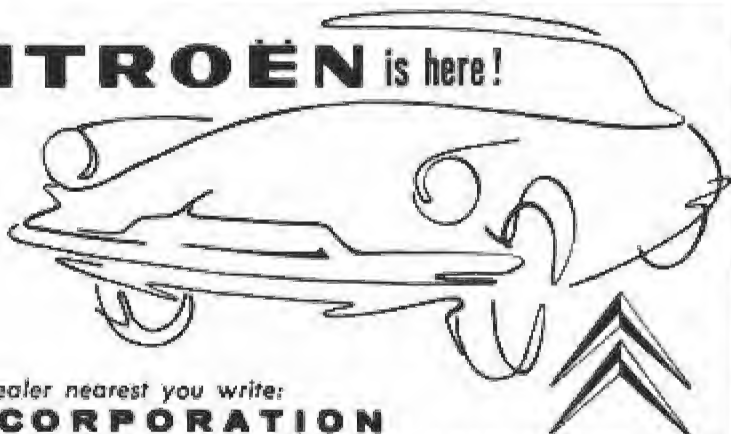
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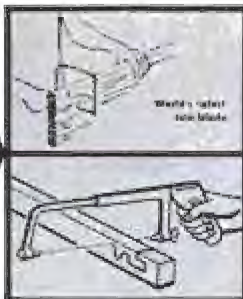
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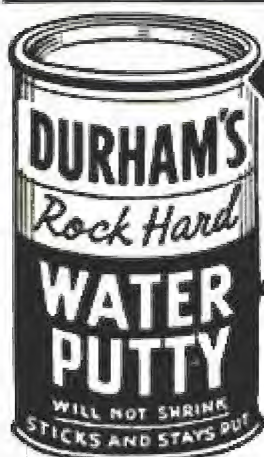


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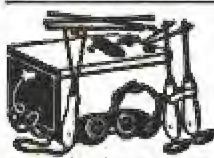
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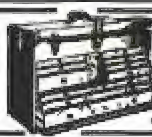


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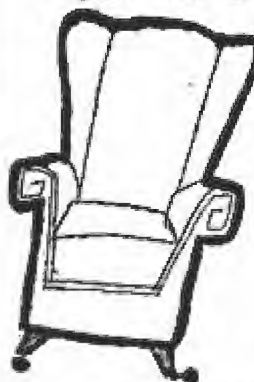
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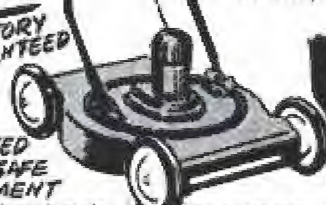
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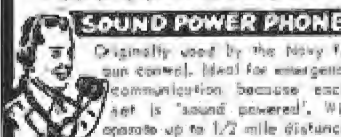
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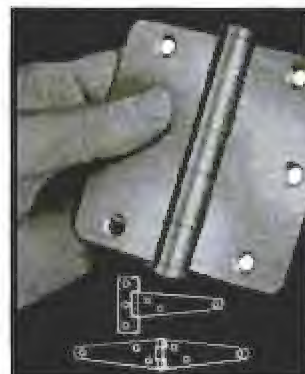
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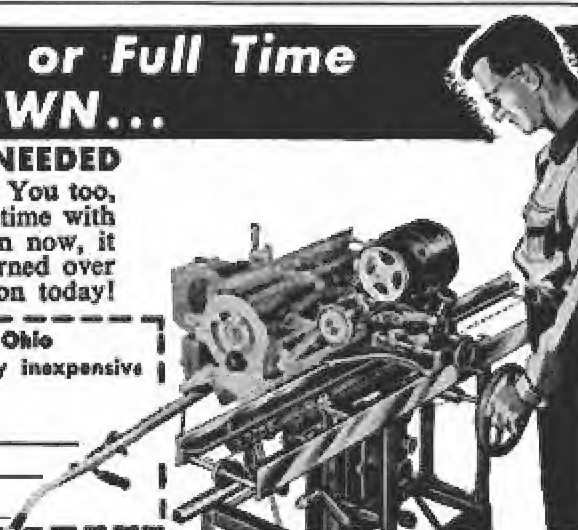
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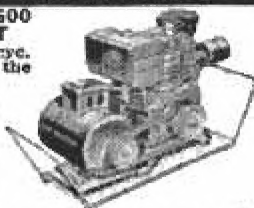
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PORTABLE LIGHT PLANTS

GIANT 2000-2500 WATT PLANT

110-120 v. 60 cyc. AC. Absolutely the best made — exclusive dynamo balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lbs. Reg. price \$585. Special at..... **\$299.50**
Same plant with electric self starter (Item 31a)..... **\$359.50**
Generator only and control box..... **\$169.50**
DUAL VOLTAGE 110-220 available on any of above models for \$28.00 additional.



Variable Speed Selector

Heavy duty, made by B. F. GOODRICH for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Employs reliable "trouble free" planetary system. No hydraulic power losses. Infinite range, smooth operation, easy installation. 3 sizes: 1/2-1 hp. 36 lbs.; 1-2 hp. wt. 55 lbs.; 2-3 hp. wt. 105 lbs. Reg. list \$228, \$252 and \$352. Our prices..... **\$79.50, \$89.50 and \$114.50**



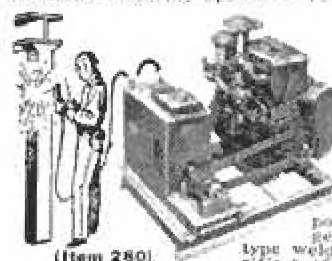
HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).
8" Pipe, wt. 5 lb..... **\$6.85**
9" Pipe, wt. 6 lb..... **\$7.85**
10" Pipe, wt. 7 lb..... **\$8.85**
12" Pipe, wt. 8 lb..... **\$9.85**
HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E)..... **\$11.95**
12" Fan, wt. 10 lbs. (Item 10D)..... **\$12.95**



FUEL OIL FILTER

Stop 90% of all oil burner & heater troubles with this big capacity fuel filter made by American Bosch. Removes every last trace of rust, dirt, tank scale and water! Easily installed—inlet and outlet have standard 1/2" pipe thread opening. (Tubing adapters included if requested). Easily cleaned by opening drain plug and flushing through—lasts for years. Saves service calls. Ideal for filtering fuel on Diesel engines too. (Item 793). Wt. 3 lbs., Regularly \$9.95 **\$4.95**
A Master Mechanic Special.....



MASTER DC ARC WELDERS

Now! a portable rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to 1/4" rods. Built-in stabilizer and cooling system makes arc easy to start and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and triple V-belt or flat pulley. Easy to hook up and easy to operate. **WELDER ONLY — DUAL CONTROL MODEL.** Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 28a). Wt. 110 lbs. \$450 value..... **\$119.50**
WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only. (Item 38). Wt. 110 lbs. \$400 value. Special..... **\$99.75**
COMPLETE POWER MASTER (Illustrated above) powered by a 14.5 hp. air-cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compared with welder costing \$1200. Factory Special..... **\$449.50**
WELDING KIT Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at..... **\$10.50**

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600-700 WATT PLANT

(Item 24)
115 v. 60 cyc. AC Powered by a rugged 2 HP. easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines..... **\$143.50**
Regular \$275.00 value..... **\$199.50**
1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine..... **\$199.50**
with 50% greater output.....

PUSH BUTTON START

RUBBER HOSE

Genuine Neoprene Hose—outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies—yet completely flexible. Equipped with standard thread male and female fittings. Pump water for irrigation, stock tanks, home, barn, fire fighting, etc.—or pump gas and fuel oil. Volume factory prices—save more than 60%.



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Length	Price
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25 ft.	13.95
50 ft.	24.75
100 ft.	49.95
10 ft.	10.95
15 ft.	14.75
25 ft.	16.50
10 ft.	9.50
15 ft.	21.50
25 ft.	21.75
10 ft.	25.50

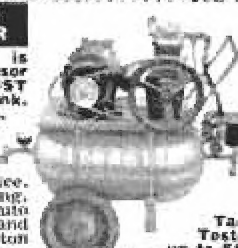
1 1/2" I.D. HIGH PRESSURE STEAM HOSE per ft. **\$1.00**
AIR HOSE Heavy duty, 1/2" I.D., 2 braided (150 lb. pressure) with standard couplings. 20 ft. lengths..... **\$2.95**
PAINT SPRAY MATERIAL Hose 3/4" I.D. Synthetic thick wall inner tube and neoprene cover. Finest model 25 ft. lengths with standard couplings. (Item 62) each..... **\$7.50**

EXTENSION CORD

Heavy duty and very flexible. Neoprene 14-2 cable. 20 year quality. Wt. 12 lbs. (Item 185) 100 ft. Complete with rubber plug and outlet. A terrific buy at only **\$8.95**
NO. 10-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male and female fittings. Wt. 8 lbs. (Item 592a) **\$10.45**
50 ft. without fittings (Item 592)..... **\$9.45**
NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 190) Wt. 8 lbs. **\$8.95**, 100 ft. (Item 200)..... **\$12.95**

MASTER AIR COMPRESSOR

COMPARE! This is the only compressor built with a **NO RUST** stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type (4 c.f.m.) Large volume of air for heavy duty service. For painting, spraying, inflating truck & auto tires, greasing, sand blasting, etc. Piston type 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x21", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE**. Low factory prices. 1 1/2 HP Model (cap. 85 lbs.)..... **\$99.50**
Reg. \$175. (Item 209)..... **\$129.50**
1/2 HP heavy duty model, Rep.-Ind. motor & unloader switch (Item 209a)..... **\$129.50**



Tank Tested up to 500 lbs. per sq. in.

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1300-1500 WATT PLANT

115v. 60 cyc. AC Push Button Start. Powered by a 3 1/2 HP. Clinton engine. Combines big output with easy portability. Provides emergency power for operating any oil burner, sump pump, freezer, television, lights, communications systems, etc. which require up to 1500 watts. (Item 23). Wt. 110 lbs. Reg. \$475 value. Factory price..... **\$239.50**



1750 Watt Plant Powered by 4.5 Briggs engine. Electric starting & battery charging built-in. Factory price..... **\$279.50**

MASTER-LITE 2500 Watt Plant

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 6.10 HP Briggs engine, complete with all accessories. Includes control box, voltmeter, and handy plug-in power receptacle. An ideal plant for permanent or stand-by service. Wt. 235 lbs. Reg. price \$445.00 (Item 21) Factory price..... **\$329.50**



3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. \$700. Factory Price..... **\$379.50**
DUAL VOLTAGE 110/220 for any of above plants—\$30 additional.

2-Speed Aluminum Alloy WINCH

Sturdy high-speed, ball bearing winch—super tough aluminum alloy construction weighs only 60 lbs., rugged yet portable! Two speeds, first three gears for easy handling of heavy loads, (second) direct drive for fast take up. Built-in drum brake with ratchet hand lever, enables operator to ease loads down gently and lock at any point desired. Large crank handle gives extra leverage—has non-slip, two handed revolving grip. Rated at 3000 lbs. lifting capacity. Drum handles 400 ft. of 3/4" cable or 600 ft. of 1/2" cable. Ideal for contractors, farmers, boat operators—mounting on trucks, tractors, farm implement trailers etc. Easily converted for power operation. (Item 794) **\$49.50**
\$200 value—only.....



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20" 2114" 4100 30 lb. 365c **\$39.95**



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HI-FLO Centrifugal PUMP

Completely self-priming! No foot valve required. Tremendous capacity—100 gal. per min. l.p.m. Special impeller enables pump to handle muddy or sandy water. Simple to operate—simply start engine and watch the water go. Powered by a rugged, easy-starting 2 HP Briggs engine. Pre-lubricated sealed bearings for years of heavy low-cost service. **Big 1 1/2" Model, Item 502. Wt. 70 lbs. \$134.50**
Factory price.....
2" Model (150 gal. per min.) with 2 1/2 HP engine. Item 502a. 90 lbs. Fact. Spec. \$154.50

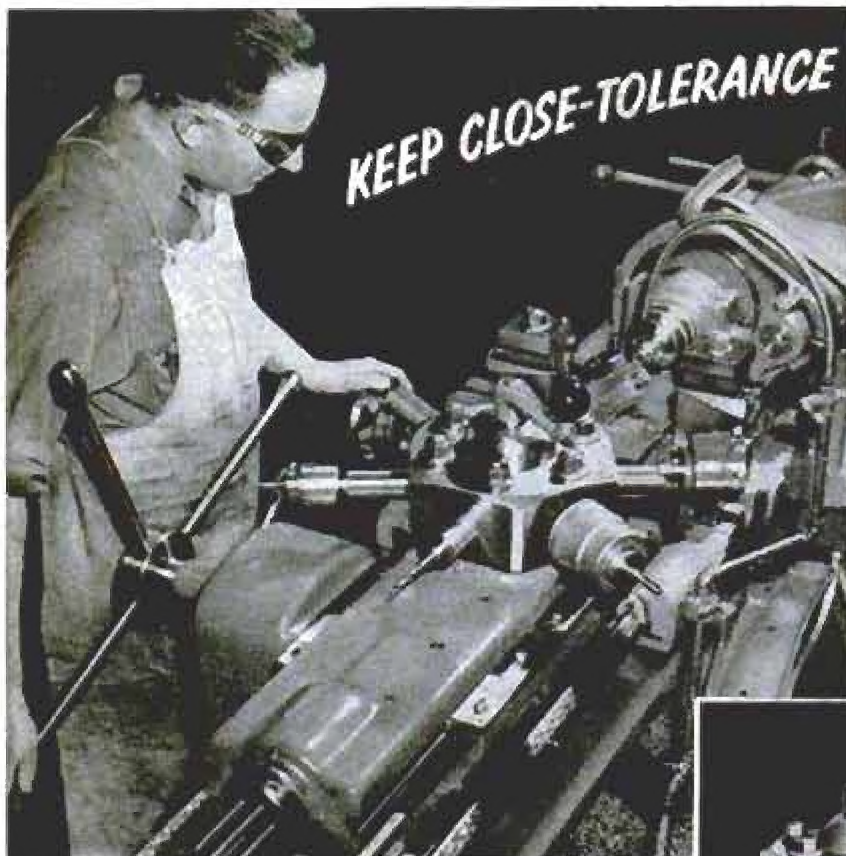


9 TON HYDRAULIC PRESS

A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crankshafts, axles, link pins and horns — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and dies to straighten any kind of curve or bend. (Item 464) Wt. 110 lb. Actual list price \$365. Our special close-out price..... **\$69.50**



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South Bend Turret Attachments are available for tooling 9", 10", 13" and 16" swing South Bend Lathes for repetitive operations. Precision built for precision work, their rigidity and accuracy permit maximum feeds and speeds. Prices of hexagon bed turrets range from \$273.00 to \$698.00. Square Turret Tool Blocks are priced from \$41.50 to \$91.00. Write for Attachment Catalog giving full information on South Bend Turrets and the complete line of South Bend Attachments and Accessories.



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